An Investigation into Cognitive and Metacognitive Strategy Use and its Relationships to EFL Reading Test Performance: A Structural Equation Modelling Approach

Panassanan Kitichaidateanan

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in English Language Teaching
April 2024

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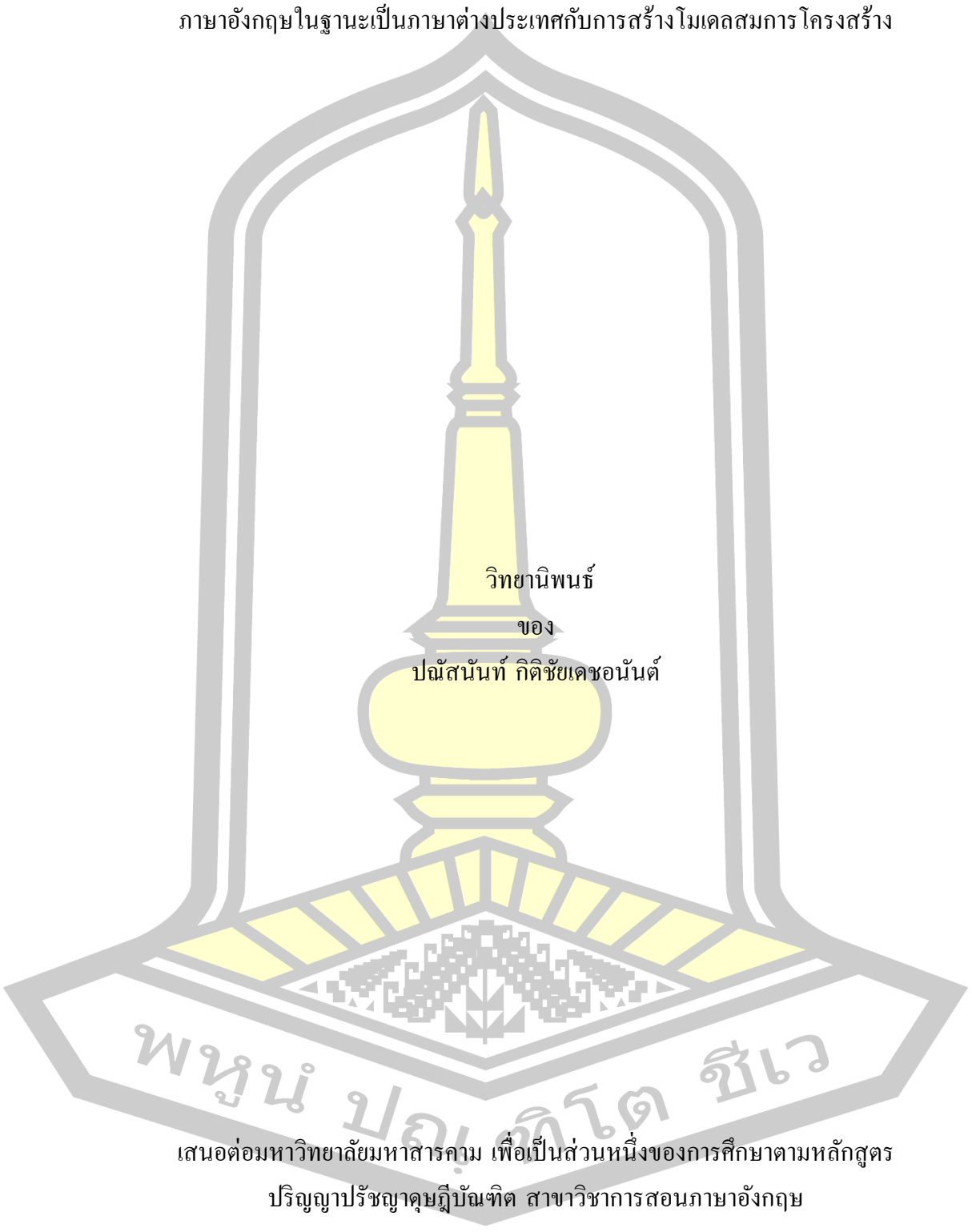

วิทยานิพนธ์

ของ

ปณัสนันท์ กิติชัยเดชอนันต์

เสนอต่อมหาวิทยาลัยมหาสารคาม เพื่อเป็นส่วนหนึ่งของการศึกษาตามหลักสูตร

ปริญญาปรัชญาดุษฎีบัณฑิต สาขาวิชาการสอนภาษาอังกฤษ

เมษายน 2567

ลิขสิทธิ์เป็นของมหาวิทยาลัยมหาสารคาม

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April 2024

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DEGREE Doctor of Philosophy **MAJOR** English Language Teaching

UNIVERSITY Mahasarakham University **YEAR** 2024

ABSTRACT

Cognitive and metacognitive strategies significantly enhance reading comprehension by promoting active engagement with texts and enabling learners to regulate their learning. Cognitive and metacognitive strategies also aid in understanding, interpreting, and responding strategically to reading tasks, particularly in testing environments, leading to improved reading skills and academic achievement. Therefore, this research aims to explore strategic competence by investigating how strategic knowledge (cognitive strategies) and strategic regulation (metacognitive strategies) influence reading comprehension test performance over a three-month period. It delves into the correlations between high school learners' self-reported strategy use (trait) and their actual strategy application (state) with test performance. Additionally, the study investigates the roles of cognitive strategies (memory, comprehension, and retrieval) and metacognitive strategies (planning, monitoring, and evaluation) in reading comprehension tests using structural equation modelling (SEM). A total of 685 high school students from a Thai government school participated voluntarily. They completed a six-point Likert scale questionnaire about their strategy use before and immediately after each reading comprehension test. To ensure diverse perspectives, 12 participants were chosen through stratified sampling for interviews, representing low, moderate, and high proficiency levels based on their test scores. The results of the SEM analysis offer profound insights into the dynamics of cognitive and metacognitive strategy use in enhancing reading comprehension. Firstly, it was observed that the employment of both trait and state strategies is influenced by the linguistic mode and context, demonstrating that their effectiveness is context-dependent with a notable correlation in aspects of comprehending, memory and retrieval strategies. Importantly, these strategies exhibit temporal instability, indicating a variability in strategy use over time. This variability extends to their relationship with reading comprehension test performance, which was found to differ, suggesting that the impact of these strategies on test outcomes is not uniform. The analysis further revealed the intricate, nuanced, and multifaceted nature of cognitive and metacognitive strategies, highlighting the complex relationship between these strategies and their influence on reading comprehension tests. Notably, cognitive strategies were found to have greater stability over time than metacognitive strategies,

suggesting a foundational role in reading comprehension. However, metacognitive strategies were identified as having a direct and variable influence on cognitive strategies, which, in turn, affected reading comprehension test performance in nuanced ways. This complex interrelationship underscores the critical importance of metacognitive strategies in orchestrating cognitive strategy use, pointing to significant pedagogical, methodological, and theoretical implications. These findings advocated for teaching approaches that are responsive to the dynamic and multifaceted nature of strategy use, emphasizing the need for educators to foster both cognitive and metacognitive strategy application to affectively enhance reading comprehension skills.

Keyword : cognitive strategies, metacognitive strategies, reading comprehension test, trait and state strategy use, Thai high school learners

ACKNOWLEDGEMENTS

Reviewing the entire process of completing the thesis is full of challenges and rewards. This thesis would have been difficult to achieve in the short four-year postgraduate life without those who supported and helped me during my thesis writing. I am honoured to take this opportunity to express my heartfelt thanks to those who helped me with this thesis. First of all, my deepest gratitude goes, first and foremost, to my advisor, Assistant Professor Dr. Apisak Sukying. He has patiently guided and cared for me, whether academically or while studying. Especially during the completion of the thesis, he was meticulous and patiently answered related questions and confusions. From selecting the thesis topic to finalising the thesis, he gave me many valuable suggestions for revision. During the preparation of the proposal and thesis defence, he repeatedly asked me to answer the questions that needed to be paid attention to. In the process of writing the first draft of the thesis, he always reminded me of the progress of writing and instructed me on how to write the thesis carefully via e-mails, messages, face-to-face, etc. After the first draft of the thesis was completed, he carefully corrected the thesis repeatedly. From the wording and sentence of the thesis to the overall layout of the thesis, he gave me many related suggestions. In short, accomplishing my thesis was inseparable from his dedication to me. Here, I would like to extend my heartfelt gratitude and high respect to him.

Secondly, my appreciation also goes to the external and faculty committees who have generously shared their research knowledge, experience and intelligent and valuable comments and suggestions that inspired my study. They have profound knowledge and an attitude of rigorous academic scrutiny and excellence. They have provided useful information to help me conduct the study and develop the thesis, particularly in research instruments. I would like to express my genuine thanks to the lecturers and experts for their feedback on my research instruments. They have given me more informative and helpful advice to develop my research instruments before collecting data. Also, I thank Dr. Shauna Parkes, who helped proofread and edit my thesis. I am very grateful for her time and attention to this thesis.

I owe special thanks to the schools and teachers who were supportive and helpful in my data collection. In addition, my special thanks go to all the participants

who participated in the study, including students and their teachers, for their excellent cooperation while conducting the reading comprehension test performance. Furthermore, I would like to thank the Faculty of Humanities and Social Sciences, Mahasarakham University, for granting me the research scholarship and funding. Thanks also go to the ELT Programme for providing me with rare learning opportunities and a serious, responsible teacher team and the graduate school staff, which plays a key role in the smooth progress of my academic research. Their inspirational and wonderful lectures have provided me with a firm basis for the composition of this thesis. Thanks to Jiraporn Noipa, Dr. Rangsawoot Martwangsang, Dr. Worakrit Nontasee, Sutthiwan Munponsri, Thongpanh Malivong, and my doctoral's degree and master's degree friends. The discussions, hangouts, general help, and friendship were greatly appreciated. To my other friends, thank you for your thoughts, phone calls, texts, and being there whenever I need a friend.

Finally, I also want to thank my family for their support and help in the process of writing my thesis. During my ELT journey, I had a fulfilling and unforgettable experience in such a friendly and caring environment. Once again, I sincerely thank everyone around me. Without your help and concern, my thesis wou

I owe special thanks to the schools and teachers who were supportive and helpful in my data collection and those students who contributed to my study for their collaboration and patience.

I would not have been completed smoothly. I, again, extend my thanks to all those mentioned above and to any others I may have failed to mention. Finally, and most importantly, I would like to thank my mom, husband and family for their encouragement, quiet patience, and unwavering love. Thank you for your tolerance of my occasional moodiness, and thank you for just being there for me. Words cannot express my gratitude for your unconditional love and support.

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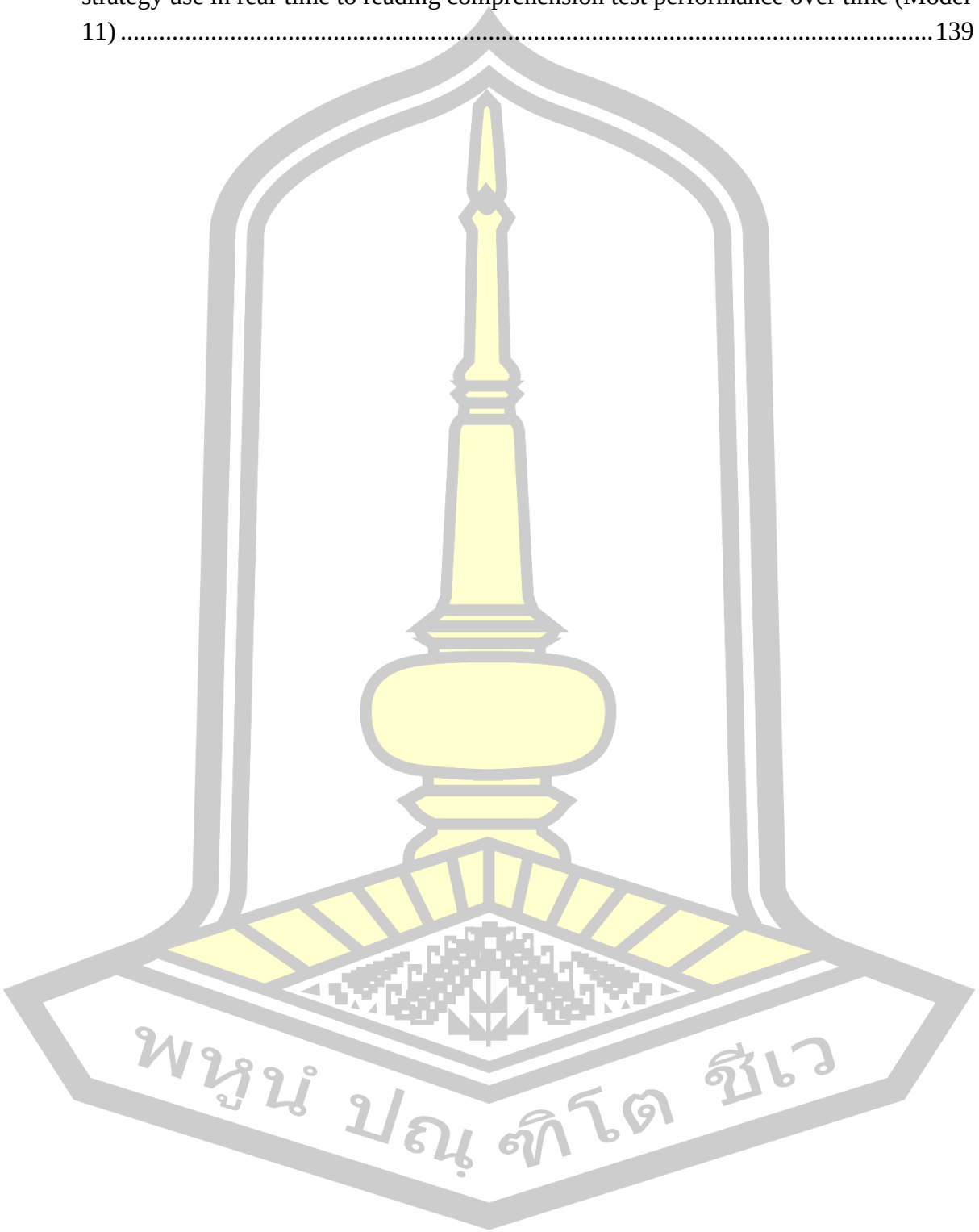

CHAPTER I
INTRODUCTION

1.1 Background of the study

Over the last few decades, there has been a strong interest in investigating the individual characteristics of second language (L2) learners (Cohen & Macaro, 2007). Notably, one individual difference variable, language learner strategy, has attracted considerable research attention (e.g., Cohen, 2011; Griffiths, 2008; Oxford, 2011, 2017; Phakiti, 2008b; Purpura, 2014, 2016; Sukying, 2021; Zhang, 2016a; Zhang, Chin, Gong, Min, & Tay, 2016; Zhang, 2018; Zhang, Goh, & Kunnan, 2014; Zhang & Zhang, 2013). This research has focused on identifying successful readers' behaviours and strategies while reading (e.g., Dembo & Seli, 2014; Macaro & Erler, 2008; Sukying, 2021; Zhang, 2018).

Some language testing (LT) researchers have proposed different models to describe communicative language ability (CLA). For example, Hymes (1972) proposed the concept of communicative competence, which stated that a person's capabilities depend on both their tacit knowledge and their ability to use it. This differed from Chomsky's (1965) definition of competence; for Chomsky, competence was knowledge, but for Hymes, competence was knowledge and ability. Later, Canale and Swain (1980) proposed their influential communicative competence theory, refined by Canale (1983a). In their initial framework, communicative competence consisted of grammatical, sociolinguistic, and strategic competence. Then, Canale (1983a) developed the model and added discourse competence, which referred to knowledge of the connections among utterances in a text to form a meaningful whole. Canale (1983b) also extended the definition of strategic competence to include both compensatory and enhancement functions of production strategies. In other words, Canale and Swain incorporated grammatical, sociolinguistic, discourse, and strategic competence into the model of language knowledge.

Bachman (1996, 2010) proposed a multi-componential CLA model comprising language competence, strategic competence, and psychophysiological mechanisms. This model viewed language competence as a set of specific knowledge components employed in communication subdivided into organizational competence and

pragmatic competence. Organizational competence included grammatical and textual competence. Grammatical competence was the language use competencies with some independent knowledge, such as vocabulary, morphology, syntax, and phonology/graphology. By contrast, textual competence entailed understanding the standards for connecting sentences to create a text (composed of two or more sentences) arranged according to cohesion and rhetorical organization rules.

With reference to Bachman and Palmer (2010), CLA comprised two essential components: language competence and strategic competence. Language competence was a domain of information in memory available for use by strategic competence. Strategic competence was viewed through planning strategies, monitoring strategies and evaluating strategies. A similar trend has been noted in language testing, with a growing interest in researching the cognitive characteristics of test-takers that might affect their success on language tests. This concern emphasizes the importance of learning strategy research findings for language testers since a test-taker's use of strategies might be a significant factor in test score variation. Later, Bachman and Palmer (2010) claimed that language knowledge was guided by a set of strategies that determine how language is realized in real-world situations.

Based on Bachman and Palmer's (1996, 2010) model of CLA, test-taking strategies on reading tests are informed by the concept of strategic competence. Competence is considered a set of metacognitive strategies that individuals use to regulate their cognitive processes to achieve their communicative goals. These strategies are fundamental for managing and directing the cognitive operations involved in test-taking, which includes planning, monitoring and evaluating an individual's performance.

Strategic competence involves metacognitive strategies and cognitive strategies. It is a complex interaction that goes beyond simple awareness and regulation of cognition. Take reading comprehension tests as examples; successfully applying the test-taking strategy would require integrating knowledge about text structure, vocabulary, grammar, and inferencing skills to construct meaning from the text. Studies on strategic competence in language testing have broadened the scope to include these

multiple facets (Purpura, 2014; Phakiti, 2008). The use of trait strategies (perceived strategic knowledge) and state strategies (actual strategy use) can provide insight into how test-takers approach a reading task and their performance over time. Such studies advocate for a comprehensive understanding of strategic competence that includes cognitive and metacognitive strategies and recognizes the influence of affective and social factors on test performance.

In language testing (LT), test-taking strategies were problem-solving approaches or tactics used by test takers attempting to answer question items on a particular language test or other types of assessment (Cohen, 1992, 1998). Test-taking strategies included test-management and test-wiseness strategies, with the former including the use of construct-relevant response behaviors and the latter involving the use of non-construct-relevant textual and/or technical parts of the test (Acosta, 2019; Cohen, 2006; Phakiti, 2008; Zhang & Guo, 2020). In this view, a test-taking strategy was called contributing or successful if it resulted in the correct response to a particular question; otherwise, it was noncontributory or ineffective (Assiri, 2011). Test-taking strategies were compensatory, similar to language use strategies; meanwhile, the former was employed for communication goals, and the latter was used for test-taking purposes. The language test was primarily used to infer and draw conclusions about the test-taker's language proficiency (Bachman & Palmer, 1996, 2010).

A plethora of LT studies uncovered that the application of cognitive and metacognitive strategies was positively related to test-taking strategies on reading test performance (e.g., Anderson, 2005; Bernardo & Mante-Estacio, 2023; Phakiti, 2003; 2006; Purpura, 2014; Zhang, 2018). Other studies have also found that the use of cognitive and metacognitive strategies was greater among more successful readers than less successful readers (Cohen, 2007; Oxford, 2011; Griffiths, 2013; Macaro, 2006; Phakiti, 2006; Sukying, 2021). Cognitive strategies also impacted L2 performance because they were directly involved in the use of the target language (Anderson, 2005; Bachman & Palmer, 2010; Chamot, 2005; Oxford, 2011, 2017).

Studies have also attempted to examine the influences of test-takers' characteristics, including learner background, language ability, prior knowledge, pragmatic knowledge, learning styles and socioeconomic experience (e.g., Bachman, 2000;

Oxford, 2011; Phakiti, 2007). Among these studies, Phakiti (2007), for example, employed the SEM approach to analyse the effects of test-taker characteristics such as language exposure, strategy use, and aptitude on EFL reading test performance. Lumley and Sullivan (2005) investigated the interactional effects of the task topic, gender. Other studies have attempted to examine how test-takers respond to given test tasks. Some LT research identified test-taking strategies through introspective or retrospective reports and related test-taking strategies to test performance (Cohen, 2000). LT research also showed that test-taking strategy studies could yield fruitful information concerning (1) the nature of low-level versus higher-level processing on a language test, (2) whether strategies used in L2 test-taking are typical to L2 use, (3) the effect of using authentic versus inauthentic texts in reading tests, (4) the more effective strategies for test accomplishment and the less effective ones, and (5) test items that would be susceptible to the use of test-wiseness strategies (Cohen, 2007; Phakiti, 2003, 2006).

Only a few published studies have validated Bachman and Palmer's (2010) strategic competence model. For instance, Purpura (1999) investigated the relationships between perceived cognitive and metacognitive strategy use and language test performance. He examined the connection by applying the structural equation modelling (SEM) approach with 1,382 participants who responded to a context-free strategy use a questionnaire before test-taking. His findings showed that cognitive processing was a multi-dimensional construct covering a group of comprehending, memory and retrieval strategies. These complicated cognitive strategies worked with one another to influence language performance. The SEM model of metacognitive strategy applications was discovered to be a unidimensional construct comprising a single set of assessment processes, including goal setting, planning, monitoring, self-evaluating and self-testing. Purpura (1999) also indicated that metacognitive processing had significant, direct and positive impacts on all three cognitive strategy components, directly affecting language test performance. These findings suggested that metacognitive strategies mediate the effects of cognitive processes on test performance. Purpura (1999) also uncovered that the high-ability test-takers tended to apply metacognitive strategies more automatically than the low-ability peers. In turn,

these different patterns significantly affected their test performance. Purpura suggested that Bachman and Palmer's (1996) strategic competence model must be extended beyond a set of metacognitive strategies because individual test-takers appeal to cognitive, affective and social strategies and metacognitive strategies when they employ the target language.

Following the work of Purpura (1999), Song (2004), using a revised questionnaire, examined the strengths of cognitive and metacognitive strategy use to explain Chinese test-taker's performance in the college English Test Band 4 using regression analysis. It was found that cognitive and metacognitive strategies explained 8.6% of the test scores. A later study through the Michigan English Language Assessment Battery (MELAB) used exploratory factor analysis (EFA), and regression analysis indicated that the effect of strategy use on the language test performance was weak to moderate, accounting for some 12.5 to 21.4% of the score variance (Song, 2005).

In the Thai context, Phakiti (2003) scrutinized the association between 384 Thai university learners' cognitive and metacognitive strategy use and their reading test performance through the use of a cognitive and metacognitive questionnaire, retrospective interviews and an EFL achievement test. Phakiti (2003) employed the factor structures from exploratory factor analyses (EFAs) to form composites of cognitive and metacognitive strategies for further quantitative studies and indicated that metacognitive strategies were statistically positively associated with cognitive strategies. He also showed a statistically positive relationship between cognitive and metacognitive strategy use and reading test performance, accounting for around 15% to 22% of the test score variance. The results also indicated statistical differences in the reported use of cognitive and metacognitive strategies between more and less successful students (Phakiti, 2003). A more recent study by Phakiti (2006) investigated the nature of cognitive and metacognitive strategies and their direct and indirect associations with EFL reading test performance among 358 Thai university learners using the SEM approach. The results showed that memory and retrieval strategies accelerated comprehending strategies. It was also found that monitoring strategies performed an executive function on memory strategies, whereas evaluating strategies regulated retrieval strategies. Yet, the study indicated that planning

strategies did not directly control the cognitive processes but handled them through monitoring and evaluating strategies.

Based on the comprehensive review of the existing literature, only a few studies have attempted to examine the nature of cognitive and metacognitive strategies and their relationships to EFL reading test performance. To the best of the researcher's knowledge, little research looked into the relationship between cognitive and metacognitive strategies and EFL reading test performance at a high school level in the Thai EFL context. In following the work of Phakiti (2006), the present study sought to fill the gap in the literature by investigating the nature of Bachman and Palmer's (1996, 2010) strategic competence. There was also a need for further analyses of the factors of cognitive and metacognitive strategies. The current study also attempted to examine the extent to which strategy use affects EFL reading test performance. The study of relationships between strategy use and EFL reading test performance would provide deeper insights into theoretical, methodological, and pedagogical implications for L2 reading and teaching, language testing, and second language acquisition (SLA). Theoretically, this study would clarify the nature of cognitive and metacognitive strategies and their relationships to EFL reading test performance over time. Methodologically, this study used the SEM approach that allowed measurement errors to be incorporated into parameter estimation. Pedagogically, though not directly involved in the effects of strategy training on EFL students' strategic development, it could offer practical insights that could be applied in an L2 classroom.

1.2 Purposes of the study

Prior studies have established a connection between metacognitive and cognitive strategies, whereby these strategies influence the reading performance of the learner. Concerning the performance of Thai EFL high school students on reading comprehension tests and the nature of cognitive and metacognitive strategies, cross-sectional and longitudinal research in this area is scarce. As such, the present study examined the nature of trait and state strategies and their links to Thai high school students' reading comprehension test performance. The study also investigated the nature of cognitive and metacognitive strategies and their relationships with the

reading comprehension test performance of high school learners. Finally, the study further examined the extent to which these cognitive and metacognitive strategies influence Thai high school learners' performance on reading comprehension tests cross-sectionally and longitudinally. This study was achieved through the utilization of both quantitative and qualitative data analyses. The following questions were formulated to provide directions for the study:

1. What is the nature of trait and state cognitive and metacognitive strategies and their relationships to reading comprehension test performance among EFL high school learners?
2. To what extent do cognitive and metacognitive strategies exhibited by traits and states affect Thai EFL high school learners' performance on reading comprehension tests?
3. How stable is trait and state cognitive and metacognitive strategy use on reading comprehension test performance over time?
4. What is the nature of cognitive and metacognitive strategies and their relationships to reading comprehension test performance among Thai EFL high school learners?
5. To what extent do cognitive and metacognitive strategies affect Thai EFL high school learners' performance on reading comprehension tests?
6. How stable is cognitive and metacognitive strategy use on reading comprehension test performance over time?

1.3 Scope of the study

The present study analyzed quantitative and qualitative data to explore the relationships between cognitive and metacognitive strategies and their relationships to English as a foreign language (EFL) reading test performance among Thai high school learners. The current study focused on cognitive and metacognitive strategy use based on Phakiti's (2007) framework. The participants were Thai EFL high school learners, and all had at least ten years of English-studying experience in common. This study used a longitudinal research design (Phakiti, 2014) and several research instruments, including a questionnaire, an EFL reading comprehension test, a

retrospective interview and the structural equation modelling approach (SEM) to better understand the strategies used in EFL reading test performance.

1.4 Significance of the study

Scholars have proposed most studies on the relationships between strategy use and language competency (e.g., Cohen, 2006; Phakiti, 2008; Rupp et al., 2006; Wang, 2016; Zhang, 2018) and have found that cognitive and metacognitive knowledge strategies contribute to increasing reading comprehension (e.g., Ahmed, 2019; Ali & Razali, 2019; Osuji, 2017).

This large-scale study might provide a better opportunity than most previous studies to generalize the results related to cognitive and metacognitive strategy use. Theoretically, this study would clarify the nature of cognitive and metacognitive strategies and their relationships to EFL reading test performance over time. In regard to methodological implications, this study used the SEM approach that allowed measurement error to be incorporated into parameter estimation. This analysis was realistic because the measure was not without error.

The findings of this study significantly impact several practitioners and stakeholders, including parents, teachers, administrators, educational policymakers, and higher education institutions with high school students' reading comprehension achievement. Specifically, it would reveal how individual characteristics could improve high school reading instruction, like strategy use in reading comprehension. The study of EFL learners and the use of cognitive and metacognitive strategies in reaction to reading performance was expected to yield insights into how this population of test-takers approached and performed the reading tasks on the test. Such knowledge would enable the researcher to recommend classroom practice, test-takers, and test-preparation programs. This would support the development of high-quality, research-based reading instruction and demonstrate to policymakers the relationships between cognitive and metacognitive strategy applications and reading performance. With pedagogical implications, though not directly involved in the effects of strategy training on EFL students' strategic development, it could offer practical insights that could be used in an L2 classroom.

1.5 Definitions of key terms

Definitions of terms in this research are described as follows:

Strategy use is related to strategic competence, including strategic knowledge and regulation in human information processing.

Cognitive strategies include comprehending, memory, and retrieval strategies based on the theory of human information processing.

Metacognitive strategies include planning, monitoring, and evaluating strategies based on the theory of human information processing.

Trait strategy refers to a perceived strategy that one believes that one will use during the test, which is reported by the students before the test.

State strategy is the strategy that one actually uses during the test, which is reported by the students immediately after the test.

Reading, interchangeably used with **L2 reading**, is a complex, dynamic, and multidimensional skill. This skill involves interactions among various linguistic and non-linguistic skills ranging from lower-and higher-level skills to higher-order knowledge of text representation and integration of comprehension using topical knowledge and higher-order regulation via monitoring and evaluation.

Test-taking strategies refer to the problem-solving techniques or tactics used by the test-taker during which they attempt to answer question items on a particular language test or other types of assessment.

Structural equation modelling (SEM) is a statistical methodology used for taking a hypothesis-testing approach to multivariate analysis. The term can be broadly defined to accommodate models that include latent variables, multiple indicators, reciprocal causation, simultaneity, and interdependence.

1.6 Organization of the Thesis

This thesis is structured into seven chapters with the first chapter providing an overall picture of the study for the readers. It gives the readers the rationale and scope of the

current research. This chapter also provides an overall picture of the thesis, including research purposes and key term definitions.

Chapter II outlines theoretical framework and critically reviews related studies to construct the study. The chapter begins with definitions of communicative linguistic ability (CLA), reading comprehension test results, and strategy utilization (cognitive and metacognitive methods). The chapter provides a critical analysis of prior research about the relationship between strategy utilization and performance on reading assessments. In addition to a vital examination of regularly used instruments that assess the impact of cognitive and metacognitive strategies on test performance, this study concludes with research from prior research on Thai reading comprehension and cognitive and metacognitive strategies.

In Chapter III, the research design is comprehensively delineated, encompassing the research paradigm, participants, setting, and research questions, in order to establish the framework for this study. Additionally, this chapter details the instrumentation, data collection procedures, and analysis methods for the current investigation.

In Chapter IV, the results of the pilot study are presented. This chapter details the methodology and content validity of the pilot study. The outcomes of the pilot study, which offer empirical support for decisions regarding instrument creation and test administration arrangement, are also presented in this chapter. It assesses the measurement tools employed in the research, evaluates the criteria utilized to choose and exclude participants, and offers training to researchers and research assistants to validate the study's feasibility. In addition, the chapter evaluates the suitability of the methodology to gather data.

Chapter V discusses the quantitative results and provides an analysis. To begin, the descriptive statistics pertaining to Time 1 and Time 2 are utilized to address Research Question I. Additionally, the chapter provides an overview of the results obtained from longitudinal and cross-sectional SEM analyses that address Research Questions II through VI. These questions concern: (a) the characteristics of cognitive and metacognitive strategies employed by EFL high school students, including the level of achievement they attain on reading comprehension assessments; (b) the correlation

and regression outcomes between trait and state reading comprehension test performances and SE at Time 1 and Time 2; and (c) the extent to which these strategies influence SE. This chapter concludes with a consideration of the quantitative outcomes of communicative language competency.

Chapter VI presents qualitative findings and a comprehensive analysis of those findings. It establishes connections between these conclusions drawn from quantitative data and provides fresh viewpoints that are not challenged by the quantitative results. Additionally, the chapter elaborated on the characteristics of the strategies employed by Thai high school students.

Chapter VII presents the conclusion, implications, and limitations of the research. It begins with a summary of the findings and the substantial contribution to understanding how the utilization of cognitive and metacognitive strategies influences reading comprehension test performance. This chapter analyses the quantitative and qualitative data about implementing techniques and their correlation with the performance of L2 reading comprehension assessments among Thai high school EFL learners. Furthermore, the importance of cognitive and metacognitive methods in L2 language communication, particularly in the domains of L2 reading processing and language assessment, is underscored. In addition, the limitations of this study and implications for future research are discussed in this chapter.

CHAPTER II
LITERATURE REVIEW

This chapter presents the strategies used by test takers and how these strategies relate to high school learners' reading test success in English as a Foreign Language (EFL). First, communicative language abilities were described, then strategy use was outlined, including types of language learner strategies, the construct of cognitive and metacognitive strategies, and cognitive and metacognitive strategy use and language testing performance. The following section examined how language testing was assessed, including definitions of language testing (LT), factors affecting language test performance, and research on factors affecting language testing performance. Then, EFL reading, including reading models, strategies for reading comprehension, and language tests for reading comprehension, are described. Previous studies on strategy use and EFL reading test performance were also discussed. Finally, this chapter defined key terms for the present study.

2.1 Communicative language ability

According to social and contextual factors, communicative language ability (CLA) is highly complex, multidimensional and variable (McNamara, 1996). Therefore, language testing (LT) researchers have proposed different models to describe CLA. For example, Hymes (1967, 1972) proposed the concept of communicative competence, which states that a person's capabilities depend on both their tacit knowledge and their ability to use it. This differs from Chomsky's (1965) definition of competence; for Chomsky, competence is knowledge, but for Hymes, competence is knowledge and ability. Later, Canale and Swain (1980) proposed their influential communicative competence theory, which was refined by Canale (1983a, b). In their initial framework, communicative competence consisted of grammatical, sociolinguistic, and strategic competence. Then, Canale (1983a, b) developed the model and added another component (i.e., discourse competence) to distinguish it from sociocultural competence. Discourse competence refers to knowledge of the connections among utterances in a text to form a meaningful whole. Canale (1983b) also extended the definition of strategic competence to include both compensatory and enhancement functions of production strategies. In other words, Canale and

Swain incorporated grammatical competence, sociolinguistic competence, and strategic competence into the model of language knowledge. In addition, they presented the notion of discourse competence.

However, the weakness of this model is that it does not demonstrate how its many components interact with one another and with the context in which language is used. This issue is addressed in detail below with Bachman's (1990) model of communicative language ability. Bachman (1990) proposed a multi-componential CLA model comprising language competence, strategic competence, and psychophysiological mechanisms (see also Bachman & Palmer, 1996). This model views language competence as a set of specific knowledge components employed in communication, which are subdivided into organisational competence and pragmatic competence. Organisational competence comprises grammatical competence and textual competence. Grammatical competence is the language use competencies that include independent knowledge such as vocabulary, morphology, syntax, and phonology/graphology. Textual competence entails understanding the standards for connecting sentences to create a text (composed of two or more sentences) arranged according to cohesion and rhetorical organisation rules.

Pragmatic competence is composed of two components: illocutionary and sociolinguistic competence. Illocutionary competence entails an understanding of pragmatic rules for executing acceptable language functions. In contrast, sociolinguistic competence is understanding the sociolinguistic conventions for performing language functions appropriately in a given context. According to Bachman (1990), strategic competence, which includes assessing, planning, and executing, is better understood as an ability or capacity rather than an area of knowledge. This model helps recognise the role of strategic competence in the test-taking situation, providing theoretical support for investigating test takers' strategies in reading comprehension tests in the present study.

Another aspect of language competence is pragmatic knowledge, including functional and sociolinguistic knowledge. Functional knowledge enables the learner to interpret the relationship between utterances and communicative functions (i.e., knowing various forms that perform the speech act of request). In contrast, sociolinguistic knowledge enables the learner to create utterances that are appropriate in context (i.e., knowing which forms to use when asking a roommate to pass you a TV remote versus asking a university professor to write a recommendation letter for a job application). Overall, pragmatic knowledge allows learners to create or interpret discourse by relating an utterance or a text to its meaning and social context.

The other critical component of CLA is strategic competence, frequently described as a higher-order executive mechanism or a set of metacognitive strategies that provides cognitive management. Strategic competence is viewed as "a set of metacognitive components or strategies" that "provide a cognitive management function in language use" (Bachman & Palmer, 1996, p. 70). Indeed, strategic competence comprises three components. The first entails goal setting, which involves deciding what the language user will do when facing language use or test tasks. The second component requires assessment, through which the individual associates their topical and language knowledge with the language use setting and tasks. Finally, planning concerns the individual's decision of how to use language knowledge, topical knowledge, and affective schemata to complete the tasks successfully. This framework of language ability is illustrated in Figure 1 (Bachman & Palmer, 1996).

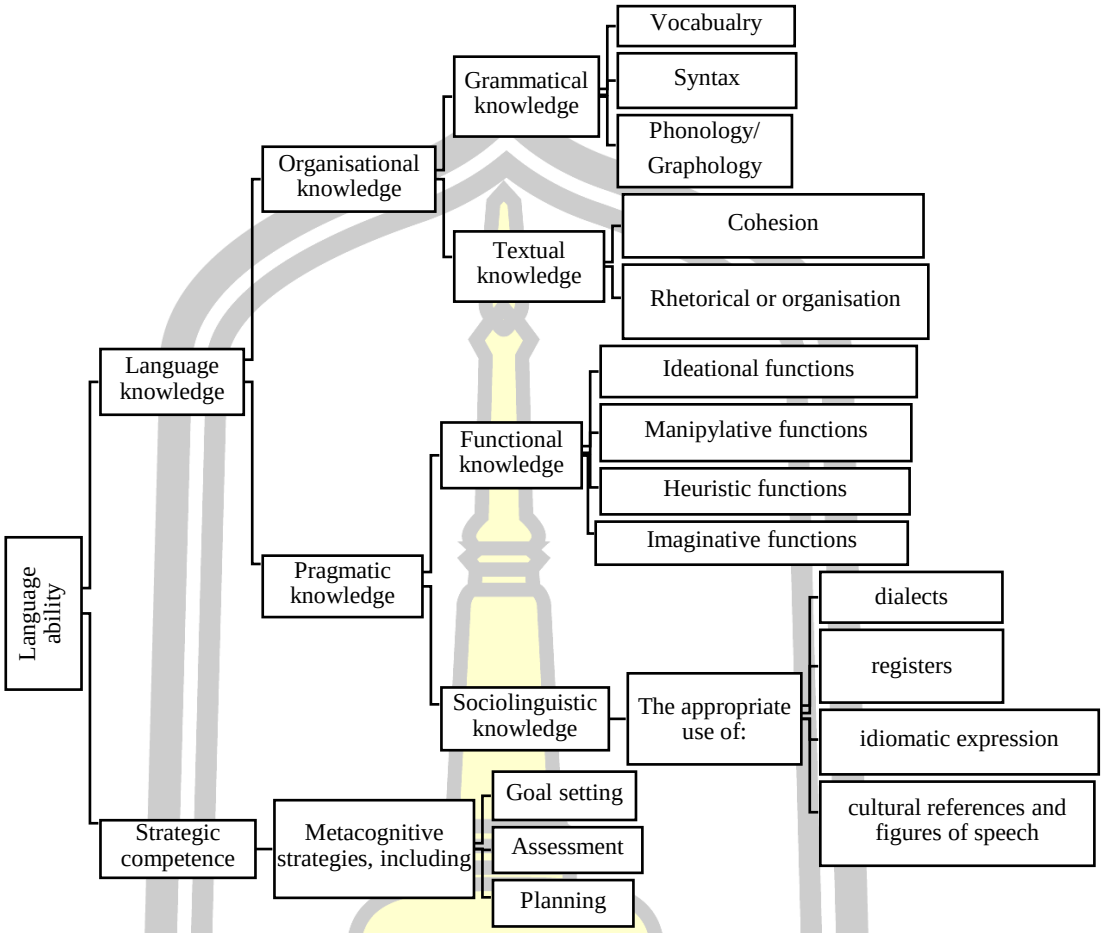

Figure 1 The framework of language ability (Bachman & Palmer, 1996)

Bachman and Palmer (2010) revised this initial framework of language ability and incorporated cognitive strategies into the model. They noted that test-takers' or language users' attributes, including topical knowledge, affective schemata, personal attributes, and cognitive strategies, are critical factors in language ability. Bachman and Palmer further argued that cognitive strategies are "what language users employ when they execute plans" in real-world language usage circumstances (Bachman & Palmer, 2010, p. 43). In this regard, both cognitive and metacognitive strategies are included in Bachman and Palmer's (2010) model of language use.

This framework of language ability can be illustrated via a reading test example. When taking such a test, the taker must demonstrate their language knowledge and cognitive and metacognitive strategy use. When students take a reading test, they show their capability in using the target language through their response to test items,

which measures their knowledge of vocabulary, syntax, phonology, and morphology. Furthermore, their textual knowledge is assessed via items examining their text comprehension ability. In response to the reading test items, test takers appear to evaluate what is required to achieve the task and their language resources. Fundamentally, test-takers formulate a plan to complete the test. For instance, they may decide to apply more inference-making strategies in reading the text and dealing with the items if they have adequate knowledge of morphology. If test-takers do not have the required knowledge, they may establish plans to skip items for better time management.

2.2 Strategy use

According to Phakiti (2003), language learners intentionally apply strategies to assist language learning and acquisition. They also purposely use strategies to improve performance (e.g., completing a language assignment, communicating with people in the target language, and taking a test). While learning strategies are continual and continuous, usage strategies are situation-specific. The following section reviews the relevant literature about strategy use in EFL reading comprehension.

Researchers studying language testing in second language (L2) situations have employed strategy usage, an individual characteristic, to explain a significant portion of the diversity in test scores (Damankesh & Babaii, 2015; Phakiti, 2003, 2008, 2016; Purpura, 1997, 1999; Song, 2005; Song & Cheng, 2006; Zhang, Goh, & Kunnan, 2014). Indeed, research on L2 teaching has shifted from focusing on the teaching approaches to the learning strategies used by learners (Purpura, 2014). This shift highlights the importance of knowing the learning characteristics that lead to success in SLA. Specifically, understanding the strategies used by different learners may help to develop more effective lessons and curricula.

To elucidate the concept of strategic competence as postulated by Bachman and Palmer (1996), one could argue that a comprehensive understanding of strategic competence necessitates examination of two aspects: (1) perceived knowledge of general strategy usage that is independent of context (i.e., strategic knowledge in LTM; as captured by Purpura, 1999); and (2) perceived strategy application within a

real-world, context-specific environment (i.e., online strategic regulation; as captured by Phakiti, 2003b). Based on findings from anxiety research (Putwain and Daly, 2014; Thomas et al., 2017; von der Embse et al., 2018), it seems possible to utilize state and trait concepts to evaluate these two dual constructs, as the concepts align with those of metacognition and anxiety research. The terms “state” and “trait” denote two distinct categories of psychological characteristics possessed by individuals: (1) a comparatively stable trait and (2) a transitory state. A state of a pertinent attribute of an individual is transitory, context-dependent, fluctuating, and unstable within a given context. In contrast, a trait of a permanent attribute of an individual remains relatively constant across occasions (despite substantial variation in the variety of settings and circumstances). Trait metacognition is represented by knowledge of cognition, while state metacognition is represented by regulation of cognition. It is essential to mention that the term “trait” does not infer an unchangeable nature (Hertzog & Nesselroade, 1987; Hamaket et al., 2007).

In LT research on strategic competence, the concept of “generally perceived strategy use” (Purpura, 1999, 2014) is related to the assessment of trait strategic competence. In contrast, the idea of perceived strategy use in a specific context (Phakiti, 2003b, Purpura, 2016) is associated with assessing state strategic competence. Strategic competence is theorized for the current study to highlight trait and state notions. Strategic knowledge or trait strategy use is hypothesized to underline generally perceived strategy use free of context, and strategic regulation or state strategy use is hypothesized to highlight actual strategy use in a specific context. Trait and state strategy use serve as theoretical facets of strategic competence. In contrast, trait and state strategy use serve as operational definitions of strategic knowledge and strategic regulation, respectively.

2.2.1 Types of language learner strategies

Since the 1970s, researchers in second language acquisition have been increasingly interested in identifying individual variations in language learners, including the methods used to acquire a second language (e.g., Griffiths, 2017; Gu, 2005; Hsiao & Oxford, 2002; Nyikos & Oxford, 1993; Purpura, 2014; Sukying, 2021). According to Oxford (2011) and Purpura (2014), language learning strategies are particular

activities done by the learner to make learning simpler, quicker, more pleasurable, more self-directed, more successful, and more transferrable to other contexts.

Different strategies have been identified and classified (Rubin, 1981; O'Malley & Chamot, 1990; Oxford, 2011, 2017). For example, Rubin's (1981) dichotomy categorisation method divided learning strategies into direct and indirect categories. The six direct strategies are clarification (or verification), monitoring, memorisation, guessing (or inductive inferencing), deductive reasoning, and practice. The two indirect strategies provide an opportunity to practice and use production techniques (Rubin, 1981). By contrast, O'Malley and Chamot (1990) classified learning strategies as metacognitive, cognitive, or social/affective strategies. Examples of metacognitive strategies include selective attention, self-management, planning, self-monitoring, and self-evaluation. Cognitive strategies include repetition, organisation, inference, summary, deduction, imagery, transfer, and elaboration. Finally, cooperation, clarifying questions, and self-talk are social/affective strategies.

Oxford (1990, 2011, 2017) further developed Rubin's (1981) direct and indirect dichotomy by offering concrete operational definitions. She defined direct strategies as those that directly involve the language being learned and indirect strategies as those that do not include the target language directly but are nevertheless helpful for learners to acquire the language. Figure 2 illustrates direct strategies (memory, cognitive, and compensation strategies) and indirect strategies (metacognitive, affective, and social strategies) according to Oxford (2011, 2017).

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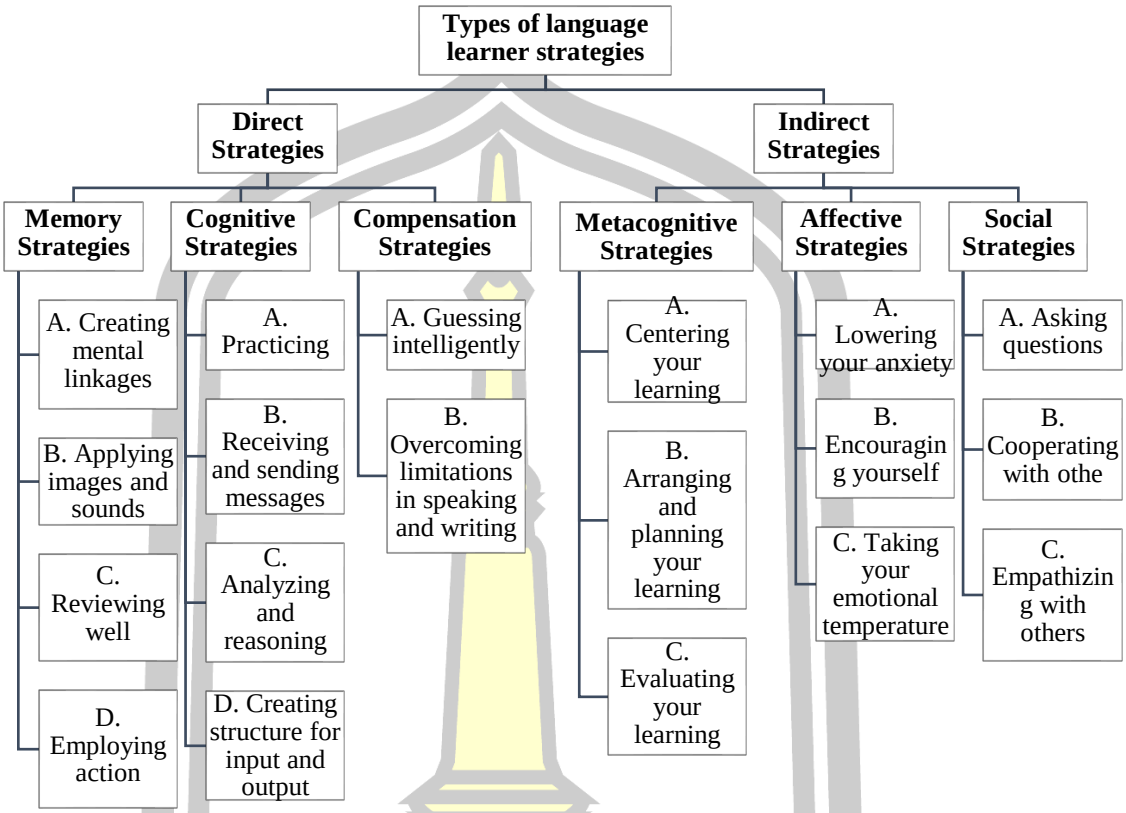

Figure 2 Types of language learner strategies (Oxford, 1990, 2011)

Cognitive strategies enable learners to manipulate language material directly (Oxford, 2017). For example, the learner uses language by reasoning, analysing, taking notes, summarising, synthesising, outlining, and reorganising information to strengthen schemas (knowledge structures), practising in naturalistic settings, and formally practising structures and sounds. The use of cognitive strategies is significantly related to L2 proficiency, specifically in EFL settings (AlQahtani, 2013; Charoento, 2017; Habok & Magyar, 2018; Oxford, 2017; Oxford et al., 1998; Kunnan, 1995). By contrast, metacognitive strategies are employed for managing the overall learning process, such as identifying one's learning style preferences and needs, planning for an L2 task, gathering and organising materials, arranging a study space and a schedule, monitoring mistakes, and evaluating task or learning strategy success (Brown, 2007; Huang & Lee, 2009; Oxford, 1996, 2011, 2017; Oxford et al., 1998; Purpura, 2014, 2016; Wu, 2008).

To summarise, learners can use various strategies to acquire language features that are essential to reading comprehension (Ecker et al., 2014; Ghafournia, 2023; Grabe & Stoller, 2020; Oxford, 2011, 2017; Phakiti, 2003, 2008, 2016; Purpura, 2016; Song, 2005; Song & Cheng, 2006; Zhang, 2018; Zhang & Zhang, 2013; Zhang et al., 2014). The present study aimed to explore the use of cognitive and metacognitive strategy use in EFL reading comprehension tasks to better understand the correlation of strategy use in test-takers.

2.2.2 The construct of cognitive and metacognitive strategies

Cognitive and metacognitive strategies are highly interconnected (Zhang & Guo, 2020); therefore, it is challenging to distinguish them as separate constructs. Indeed, metacognition is "contingent on cognition" and, therefore, is "contingent on cognitive strategies" (Veenman et al., 2006). Nevertheless, metacognition is often defined as a "higher-order agent that oversees and governs the cognitive system while still being a part of it". In a similar vein, metacognitive strategies may be seen as higher-order executive agents in charge of overseeing and regulating the usage of cognitive strategies.

Cognitive strategies

Cognitive strategies are direct language learning tools that assist learners in consciously processing meaning in the target language (Kasimi, 2012; Zhang & Guo, 2020). These strategies include comprehension, memory, and retrieval (Phakiti, 2003, 2007). Cognitive strategies are associated with understanding texts through prediction, translation, summarising, inferring meaning from context and connecting the text to the reader's prior knowledge (O'Malley & Chamot, 1990; Zhang & Guo, 2020). Cognitive strategies are widely accepted as crucial for language learners and are regarded as the initial step in the learning process (O'Malley & Chamot, 1990; Zhang, 2018). In contrast to direct language acquisition procedures, cognitive strategies are superior in assisting students in forming and revising internal mental models and receiving and producing messages in the target language with awareness. In addition, learners can connect with new material using cognitive strategies (Acosta, 2019; Hedge, 2000). Indeed, the use of cognitive strategies is critical for successful learning (Akpur, 2021; Chamot & O'Malley, 1987; Harris & Pressley, 1991; Pressley,

Borkowski, & Schneider, 1987; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989; Sukying, 2021; Wang, 2020).

While some studies have examined the strategies employed by English monolingual learners, others have attempted to identify the reading strategies used by ESL students. Both cases showed that cognitive strategies improve students' reading comprehension (Follmer & Sperling, 2018; Mosalli et al., 2022; Zhang, 2018). The present study focused on three cognitive strategies (Phakiti, 2007):

a) **Comprehending strategies** include identifying the central ideas and the author's attitudes or tones, summarising essential information, analysing the author's purposes, guessing the content of a text, translating the message into the native language, determining the meaning of unknown words using contextual clues, using a dictionary to clarify indirect meaning, and making inferences based on the available information.

b) **Memory strategies** use available typographical features in a text, such as a boldface, italics, images, tables, or figures. This material is reviewed, and notes are taken, including underlining key concepts or emphasising key details. Additionally, readers benefit by recognising preceding phrases or information and paraphrasing or simplifying the material.

c) **Retrieval strategies** include the use of prior knowledge or experience relevant to the topic, the comparison of new information in the text to text read previously, the application of grammar rules to comprehend meaning, the application of knowledge of word stems, prefixes, and suffixes, and the recall of reading purposes or task obligations.

While cognitive techniques encourage students to perform tasks consistently, cognitivism does have its limitations. For instance, the learner may acquire a method for completing a task that is not the best or most suitable for the learner or the situation (Brunfaut, 2021; Winn, 2011; Zhang & Zhang, 2013; Zhang et al., 2014).

Cognitive strategies have also been described as "deliberate actions readers take when comprehension problems develop" (Sheorey & Mokhtari, 2001: 431). They are

evoked to achieve “cognitive progress” (Acosta, 2019; Flavell, 1979: 909; Orii-Akita, 2014; Shadiev et al., 2017). For example, a cognitive strategy could be highlighting key passages in a book, rereading parts or an entire text to ensure comprehension, or slowing down the reading pace when comprehension is challenged.

Cognitive strategies have largely been defined in terms of the mental processes that underpin them and behaviours or activities that apply in the physical realm. Oxford often calls Cognitive strategies “cognitive processing” (2011: 44). They operate at three stages: ‘the declarative, associative, and procedural knowledge stages’. The declarative stage, which Chou (2013) describes as “conscious, effortful, halting, and nonhabitual,” enables learners to use strategies to help them recognise and deal with new information. At the associative stage, learners use strategies to practice newly acquired knowledge on a learning task. Finally, at the procedural stage, the strategies used at the associative stage become automated, beyond the learner’s conscious control, and can now be deployed with less effort, to the point of becoming a habitual, unconscious behaviour (Chou, 2013; Oxford, 2011).

Asmara (2017) found that most high school students are exposed to different types of texts. However, they still have problems comprehending the text, and he attempted to find the most frequently used strategies by first graders in high school which can improve reading comprehension. The study revealed that students should be familiar with various strategies to help their reading comprehension. Bimmel et al. (2001: 511) identified three distinct categories of reading strategies. Group 1 strategies include using linguistic and non-linguistic prior knowledge, which involves predicting, deducing, inferencing, and elaborating. Group 2 strategies include using text components with high information content, including skimming, searching for crucial fragments, taking notes, asking questions, and summarising. Group 3 strategies include using structure-marking components in the text’, such as linking words or phrases. However, it should be noted that some have argued that ‘questioning’ is a metacognitive strategy rather than a cognitive strategy (Phakiti, 2003). Nevertheless, Bimmel et al.’s (2001) classification was intended to include all of the strategic activities readers engage in, not cognitive strategies in particular.

Phakiti's (2003a, 2003b) conception of cognitive strategies largely corresponds to the categorisation proposed by Bimmel et al. (2001). As with Oxford (2011), Phakiti (2003b: 651) views cognitive strategies as being "directly related to the target language and world knowledge of the learners," allowing them to "construct meaning from text and perform a given task." Based on previous work (Alderson, 2005; Baker & Brown, 1984; O'Malley & Chamot, 1990; Oxford, 1990,2011, 2017; Purpura, 2014, 2016), Phakiti (2003b: 651) defined cognitive strategies as 'making predictions, translating, summarising, connecting with prior knowledge.

In summary, Bachman and Palmer's (2010) revised model of language use defines cognitive strategies as the methods used by language users while executing and actualising their language use plans. However, Bachman and Palmer (2010) referred to cognitive strategies as "peripheral" rather than "focal" attributes of test-takers (p. 43). Scholars have devoted considerable attention to exploring and defining cognitive strategies in language usage. For instance, based on Anderson's (1982, 2010) cognitive theory of learning, O'Malley and Chamot (1990) described cognitive strategies as behaviours that "involve mental manipulations or translations of materials or tasks" to enhance "comprehension, acquisition, or retention" (p. 229). Wenden (1991) defined cognitive strategies as "mental processes or activities used by learners to comprehend both linguistic and sociolinguistic content" (p. 19). Finally, Purpura (1999, 2014) defined cognitive strategies as "a collection of conscious or unconscious mental or behavioural processes or operations involved in the comprehension, storing, or retrieval of information" during language acquisition and use situations. The current study hypothesised that cognitive and metacognitive strategies are linked to students' reading comprehension performance, specifically their ability to apply their previous knowledge or experience, grammar rules, and inferred meaning from the text.

Metacognitive strategies

Metacognitive strategies are those that serve to monitor or regulate cognitive strategies. These strategies encompass the following aspects of the learning process: a) planning for learning, b) comprehension monitoring, and c) evaluation of learning after the language task is completed (Othman, 2014; Skehan, 1993). Planning for

learning refers to how readers establish reading objectives or goals and then maintain those objectives or goals. This process involves determining what needs to be completed, defining reading task expectations, preparing steps or actions before reading and conducting a text review before reading. Monitoring comprehension entails determining whether comprehension occurs, assessing comprehension when new information is encountered, maintaining concentration or attention while reading, identifying instances of confusion, and double-checking comprehension when confronted with ambiguous information. Finally, the evaluation of learning includes determining the difficulty of the text and the reading demands, engaging in self-questioning while reading, and measuring reading correctness, for example, by task completion performance. Additionally, metacognitive strategies include "assessing the outcome of any attempt to solve a problem, planning one's text movement, monitoring the success of any attempted action, and testing, amending, and evaluating one's learning procedures." (Brown, 1994, p. 115; Hartman, 2001). Students actively participate in reading lessons that use metacognitive strategies. (Othman et al., 2014). In other words, metacognitive strategies are employed to plan and monitor the reading process.

Anjomshoaa, Golestan, and Anjomshoaa (2012) examined the relationship between metacognitive strategy use and EFL reading comprehension in Kerman, Iran. 81 Iranian students of English language from the Azad University of Kerman participated in the study. Pearson Correlation analyses indicated a positive correlation between the variables of the study. According to Pressley and Woloshyn (1995), metacognitive strategy is one of the most widely recognised elements of instructional strategy models, and instructors must train learners to monitor their performance. Instructors may simply present metacognitive strategies or illustrate their use through classroom practice in conjunction with appropriate curricula. Readers should be aware of their cognition and metacognition and monitor their comprehension to grasp a text's meaning (Assiri & Alodhahi, 2018; Hasani & Pahamzah, 2022; Lin et al., 2019). They are also expected to develop an awareness of their metacognition, such as comprehending their objectives and employing various reading strategies for a variety of reading texts. Indeed, self-monitoring and self-correction are critical characteristics

of competent readers (Forbes, Poparad, McBride, 2004). The most beneficial approach to practising these two strategies is small group reading sessions.

Metacognitive strategies are generally considered to include the planning, monitoring, and evaluating learning or the reading process. However, researchers' perspectives differ when defining the behaviours comprising metacognitive reading strategies. For example, Zhang (2018: 12) described metacognitive strategies as referring to test takers' conscious and purposeful cognitive activities of controlling their test-taking and reading processes, which comprise planning, evaluating, and monitoring strategies. In addition, there is some disagreement on whether specific strategies are considered metacognitive or cognitive, such as utilising text features, context cues, typographical aids (e.g. italics), and guessing or predicting text meaning (which fall within inferencing) as Cognitive strategies (Phakiti, 2003a, 2003b).

Phakiti (2003a, 2003b) conceptualised metacognitive strategies as planning, monitoring, and evaluating the learning process or tackling a given cognitive task. According to Phakiti's model, planning, which he defines as the previewing and overviewing of a task's organisation, includes advanced preparation, issue identification, goal setting or selective attention, self-management, and goal prioritisation. Monitoring and evaluating, defined as "checking, confirming, or correcting reading performance against standards during or after reading", includes double-checking, performance evaluation, strategy monitoring and evaluation, and problem monitoring and evaluation (p.699). This present study will be based on three metacognitive strategies (Phakiti, 2007), as described below:

a) **Planning strategies** include setting reading purposes or goals, keeping reading purposes or goals in mind, determining what needs to be accomplished, identifying reading task expectations, planning steps or actions before reading, overviewing texts or reading tasks (e.g., text organisation and length) before reading, and determining when to read carefully.

b) **Monitoring strategies** include checking if comprehension occurs when coming across new information, controlling concentration or attention

during reading, noticing when confusion ensues and double-checking comprehension when encountering ambiguous information.

c) **Evaluating strategies** include assessing levels of text difficulty and reading demands, engaging in self-questioning while or after reading, evaluating accuracy in reading such as via task completion performance, checking one's comprehension performance against the text, evaluating whether the content of the text fits the reading purpose, and critically assessing the quality or validity of the information presented in the text.

Oxford's (2011) conceptualisation of metacognitive strategies is comparable to Phakiti (2003a, 2003b). In Oxford's model, metacognitive strategies include focusing, planning, obtaining information, organising information, coordinating, monitoring, and evaluating the construction of L2 knowledge based on the cognitive process. However, obtaining information, which Oxford (2011) characterised as a metacognitive activity, was never included in Phakiti's (2003a, 2003b) or Mokhtari and Reichard's (2004) conceptions of metacognitive strategies.

Bachman and Palmer (2010) state language ability includes language knowledge and strategic competence. Strategic competence is defined as "higher-order metacognitive strategies that provide a management function in language use" (p. 48), and it is divided into three parts: goal setting, appraisal, and planning. In other words, according to Bachman and Palmer (2010, 2022), metacognitive strategies determine how language competence is expressed in language usage (Bachman, 2013).

As described, metacognitive strategies have been characterised differently within the literature. For example, Purpura (1997, 2014) defined metacognitive strategies as a set of conscious or unconscious mental or behavioural activities that are directly or indirectly related to some stage of the overall language acquisition, use, or testing process. By contrast, Wenden (1998) claimed that metacognitive strategies are the skills "through which learners manage, direct, regulate, guide their learning, i.e., planning, monitoring, and evaluating" after adopting Flavell's (1979) and O'Malley and Chamot's (1990) frameworks (p. 519). "Metacognitive strategies are conscious

processes that regulate cognitive strategies, action, and other processing," including strategy planning, monitoring, and evaluation (Phakiti, 2008b; Zhang and Guo, 2019).

Notably, according to Cohen (2006), while taking language tests, test-takers must "deal with both language issues and item-response demands" (p. 308). As a result, language tests use three types of strategies: language learner strategies, test management strategies, and test wiseness strategies. Language learner strategies address language issues in tests—in the present research, these strategies are similar to reading strategies. Contrastingly, test management strategies offer relevant answers to test questions, while test wiseness strategies "avoid the need to access their real language knowledge" (Cohen & Upton, 2006). Metacognitive strategies, in this study, relate to test-takers conscious and purposeful cognitive activities of regulating their test-taking and reading processes, including planning, evaluating, and monitoring strategies (Cohen & Upton, 2006; Phakiti, 2006; Zhang, 2018; Zhang and Guo, 2019).

Based on Tseng, Domyei and Schmitt's (2006) work, Phakiti (2007) argues that the most relevant learning strategies depend on the specific learning situation, and proficient users should be flexible in their learning strategies. For example, social strategies are unlikely to be part of information processing in the case of an official examination, while in other situations, they can be the most relevant. Phakiti (2007) classifies cognitive strategies into (1) comprehending strategies, (2) memory strategies, and (3) retrieval strategies. By contrast, metacognitive strategies include (1) planning strategies, (2) monitoring strategies, and (3) evaluating strategies. Phakiti's (2007) language learning strategy theory model, shown in Figure 3, defines the cognitive and metacognitive strategies used in the current study.

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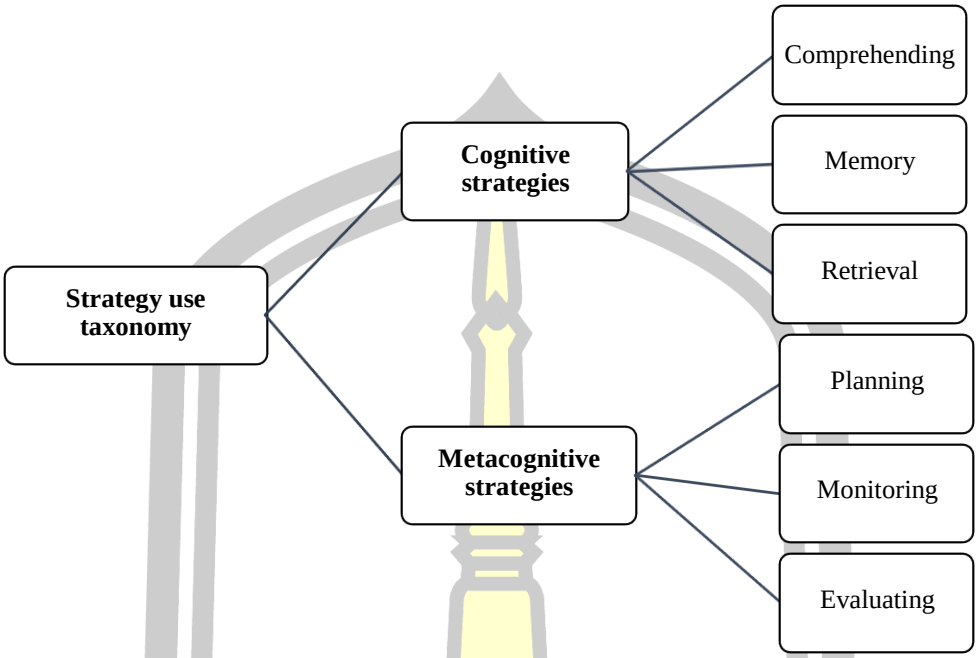


Figure 3 Taxonomy of cognitive and metacognitive strategies (Phakiti, 2007)

Cognitive strategy use refers to individual plans to tackle specific tasks during language use or in testing situations. In contrast, the use of metacognitive strategy "provides a management function in language use" (Bachman & Palmer, 2010, p.49). Based on cognitive psychology, Purpura (1999, 2016) used Gagné, Yekovich, and Yekovich's (1993) human information processing model (Kantowitz, 2021) to explain how strategies function at the different levels of information processing in test contexts. More specifically, cognitive strategies were actively involved in selective perception, storage, retrieval, and response after the incoming information entered the processing system. Metacognitive strategies, functioning robustly in the control processes, regulated all the above cognitive processes. The operationalisation of cognitive and metacognitive strategies in this study was consistent with Phakiti's (2003b, 2007, 2008) conceptualisation of these constructs. However, the current study examined cognitive and metacognitive strategies as 'state strategies' rather than 'trait strategies. This meant that the present study focused on participants' strategic management of cognitive and metacognitive strategy usage during reading tests rather than on their overall awareness of strategic knowledge. This was because the notion of 'trait strategies' for cognitive and metacognitive strategy, which was previously assumed to be stable, was once found to be unstable (Phakiti, 2008). Phakiti (2008)

also found that trait and state strategies were highly correlated, but others reported that trait strategies are more stable than state strategies (Bi, 2014). Indeed, trait strategies directly affected the use of state strategies by influencing grammar test performance, for example (Bi, 2014).

2.2.3 The relationship between cognitive and metacognitive strategy use and language testing performance

Several studies have reported a positive correlation between reading test performance and the use of cognitive or metacognitive strategies, as well as a strong positive connection between meta-awareness and the strategy used to take the exam (Kasemsap & Lee, 2015; Phakiti, 2003; Song, 2004; Rezvani & Tavakoli, 2013; Goudarzi & Ghonsooly, 2014). Below are several described studies investigating the relationship between cognitive and metacognitive strategies and reading test performance.

Phakiti (2006) examined EFL university students' cognitive and metacognitive strategies in reading exams. Memory and retrieval strategies were found to enhance EFL reading test performance through comprehending strategies. Monitoring strategies served as an executive function for memory strategies, whereas evaluating strategies served as a regulatory function for retrieval strategies. Planning strategies did not directly regulate memory, retrieval, or comprehending strategies but instead handled these cognitive strategies via monitoring and evaluating strategies. The study also examined the link between cognitive and metacognitive strategies and EFL reading test performance. It was demonstrated that the strength of the relationship varied according to the function of cognitive processing. Usually, learners need to store the language in their memory in a learning context. Memorising may add extra constraints to the flow of cognitive processing in a test-taking context. Hence, they slow down the process of comprehending text. Nevertheless, in this study, the relationships among these cognitive strategies make sense, as readers need to memorise and retrieve information for comprehension and performance demonstration purposes.

More recently, Dawadi (2017) investigated the language learning strategies used by EFL learners in Nepal. The result showed that participants were active strategy users and used cognitive strategies more frequently than metacognitive ones. Osuji (2017) also explored cognitive and metacognitive strategy use in first and second language reading comprehension among Igbo native English as Second Language (ESL) learners in Nigeria. Participants reported a medium usage level for ten out of the fourteen reading strategies included in the study, and there was no significant difference in the participants' reported use of cognitive and metacognitive strategies during the reading task. The study found that the extent to which cognitive and metacognitive strategies distinguished high performers from low performers was such that high performers were likelier to use these strategies.

Singh et al. (2021) examined the test-taking strategies of weak ESL students of an English language proficiency course. Participants reported that understanding and reading the passage helped them answer the multiple-choice questions. The findings also revealed that learners used a compensation strategy and tried to guess the answers on several occasions.

Zhang (2018) investigated the relationship between Chinese college test takers' metacognitive and cognitive strategy use and test performance on the CET-4 Reading subtest. The specific purpose of the study was to examine students' test-taking processes by identifying and characterising their strategy use on the reading comprehension test and investigating how strategy use influences their reading test performance in general and across gender groups. The results showed that metacognitive and cognitive strategies coordinate in the test environment to improve test-taker performance. The findings also suggested that metacognitive and cognitive methods can be difficult to disentangle in real-world language use situations. These results are also consistent with a previous study by Phakiti (2008).

Many studies have examined the relationship between learning strategies, test-taking strategies and test performance (see Cohen, 2011; Phakiti, 2007, for a comprehensive review). For example, Purpura (1998, 1999) found that metacognitive strategy use had a significant, direct, and positive effect on all three components of cognitive strategy

use (i.e., comprehending, memory, and retrieval strategies), which directly impacted language test performance. This relationship held across low- and high-proficiency individuals. In addition, Phakiti (2003) showed that cognitive and metacognitive strategies were positively correlated with reading test performance, accounting for around 15%–22% of test score variation. Additionally, Song (2004) found that cognitive and metacognitive strategies explained 8.6% of the variance in College English Test scores. Cohen and Upton (2007) also examined the test-taking strategies used by EFL test-takers while responding to a TOEFL subtest. Their results indicated that, whereas highly skilled test-takers relied heavily on academic reading abilities to acquire a local and broad knowledge of the exam, others relied more on test-taking and test-management strategies.

Research studies have examined the intricate connections between various strategies and the effect of strategy use on language test performance across contexts (e.g., Zhang, Goh, & Kunnan, 2014; Zhang & Zhang, 2013; Zhang, 2018). Strategic competence is likely one of the most significant cognitive factors driving performance variance and separating successful test-takers from less successful test-takers (e.g., Bachman & Palmer, 2010; Cohen, 2011 Phakiti, 2007, 2008; Purpura, 1999, 2014; Swain, Huang, Barkaoui, Brooks, & Lapkin, 2009).

For example, Phakiti (2016) investigated the nature and connections between test takers' performance appraisal calibration and reported using cognitive and metacognitive strategies during a language exam setting. Performance appraisals are strategic competence-based executive methods for assessing test performance (e.g., evaluating the correctness or appropriateness of responses to given test tasks). Calibration of appraisals refers to the precise match between appraisal confidence and actual test performance. In the study, 294 EFL students completed an English test to assess four language domains (listening, grammar, vocabulary, and reading). Immediately after answering each test question, students rated their degree of assessment confidence. After the test, they were also asked to describe their overall evaluation confidence and perceived usage of cognitive and metacognitive strategies. It was found that test-takers lacked adequate calibration across all test parts (Phakiti, 2016).

Moreover, it was shown that test-takers' assessment confidence might be used to predict more than one-third of the variance in test performance. Test takers also tended to be less confident when faced with simple questions but overconfident when confronted with difficult questions. Finally, assessment calibration was not significantly associated with the reported usage of metacognitive strategies (Phakiti, 2016). Although the study made significant progress toward unravelling the nature of appraisal confidence and calibration, as well as cognitive and metacognitive strategy use in a language test context, the findings were skewed not only by the instruments used (the test, the confidence rating scales, and the questionnaire on strategy use) but also by the test takers' characteristics (e.g., by their motivation to do well in the test; their levels of English proficiency). More specifically, the data were gathered primarily from low-ability test participants (Phakiti, 2016).

Research on strategic processing in language testing has focused on identifying strategic characteristics and quantifying strategies using quantitative (e.g., Likert-type scale surveys), qualitative (e.g., interviews and think-aloud procedures), and/or mixed-methods research. There is still a need to understand the nature and correctness of test takers' performance assessments. Data on test takers' performance appraisals, as measured by Likert-type scale questionnaires (e.g., I evaluate my test performance; I double-check my answers before submitting the test), may provide insight into specific trait dimensions of performance appraisals (e.g., a general tendency of test takers' performance appraisals). However, such research does not deduce the precise nature of test takers' performance evaluations during the exam's administration (i.e., a state dimension). Real-time performance assessments of test-takers may be a missing dimension of strategic competency that explains why some test-takers use strategies to maximise test completion more successfully than others. Indeed, Stone (2000) argues that students who correctly assess their performance success employ more effective tactics to assist them in accomplishing their objectives.

Unlike prior research, the current study will investigate test takers' performance evaluations as they finish each test question to evaluate the degree to which their performance appraisals are correct and linked to the reported cognitive and metacognitive strategy use and test performance. In addition, a qualitative research

design with a retrospective interview will be used to understand better how learners select specific strategies within each strategy category (Sukying, 2021).

In summary, strategic competence refers to "the capacity implementing the components of language competence in contextualised communicative language use" (Bachman, 1990, p.84) or a set of metacognitive components responsible for setting reading goals, assessing the quality of reading comprehension, and planning necessary steps to achieve adequate comprehension (Bachman & Palmer, 1996). Most empirical studies in L2 reading assessment have examined the relationship between test-takers' cognitive and metacognitive strategy use and their reading test performance. (Phakiti, 2003, 2008; Zhang et al., 2014; Zhang & Zhang, 2013; Zhang, 2018). L2/EFL test-takers might employ language usage strategies to complete tasks by retrieving information and abilities from long-term memory, often gained through language learning strategies in general contexts (Phakiti, 2003). In the current study, the strategy used by EFL test-takers was defined as conscious thoughts and behaviours that they used in completing specific language tasks in test contexts (Cohen, 2007, 2011; Phakiti, 2003).

2.3 Construct of EFL reading

Reading in English as a foreign language (EFL) or second language (L2) is a complex, dynamic, and multidimensional skill. This skill involves interactions among a variety of linguistic and non-linguistic skills ranging from lower- (e.g., decoding and encoding) and higher-level skills (e.g., syntax, semantics, and discourse) to higher-order knowledge of text representation and integration of comprehension using topical knowledge and higher-order regulation via monitoring and evaluation. In addition, EFL reading comprehension requires interactions between readers and contextual factors (Alderson, 2000; Phakiti, 2007). Reader factors include first language (L1), prior knowledge, language proficiency, L1 knowledge, motivation, metalinguistic knowledge, and strategy use (Alderson, 2000; Phakiti, 2007). Contextual factors include topic and content, text readability, text types and genres, and verbal and non-verbal communication (Alderson, 2000; Phakiti, 2007). In L2 reading, much of what the readers do is assumed to be the same as when they read in their first language (Grabe & Stoller, 2020). However, L2 reading can be slower and

less successful than L1. This is because success in L2 reading relies on the readers' L2 proficiency levels, tasks, and task types. It also involves complex interactions among the reader's interlanguage, personal characteristics and external factors (Alderson, 2000; Koda, 2005; Phakiti, 2007). The following section will discuss how reading has been defined in the literature.

2.3.1 Definitions of reading

Various definitions exist for reading. For example, reading is a social process to develop, structure, and sustain social interactions between and among individuals (Bloome & Green, 1984). It is also regarded as a linguistic practice since reading conveys intent and meaning between an author and a reader and amongst persons engaged in a reading event (Mossali, 2022; Sari, 2016). Anderson (2003) considered that reading is the consequence of the interplay of four elements: the reader, the text, fluent reading, and strategic reading. That is, the reader must interact with the text to digest the information within it and read it strategically to extract important information by reading the meaningful sections of the text. However, learning to read is a complicated process (Afflerbach et al., 2008; Snow, 2002) that requires several simultaneous cognitive functions (Eker, 2014; Pretorius & Lephalala, 2011). To ensure that they understand the text, readers must be competent in decoding and have sufficient vocabulary and reading fluency.

Reading is a process in which readers react to and make sense of the content they are reading with prior knowledge (Spratt, Pulverness, & William, 2005). Readers engage in this activity to learn and understand the material. To acquire information and knowledge, they attempt to relate what they read in written language to what they already know about the text. Reading may also be described as the process through which readers acquire knowledge from what they read and apply it in an academic environment as part of their education (Grabe, 2009). Learning occurs when the mind shifts from an unknown to a known item. Thus, reading is essential to learning, as readers attempt to comprehend the texts by analysing, synthesising, assessing, and selecting critical information. Indeed, according to Grabe (2009: 15), "reading is a strategic process in that several of the skills and processes used in reading require effort on the part of the reader to anticipate text information, select key information,

organise and mentally summarise information, monitor comprehension, repair comprehension breakdowns, and match comprehension output to the reader goals."

For academic readers, the reading process involves reading academic materials while using cognitive and metacognitive techniques to select and focus on the sections of the texts that are most relevant to the task goals. Academic reading also includes the ability to read different scholarly sources selectively and transition between forms of reading based on the relevancy of information in the texts and the aim of the activities.

2.3.2 Reading processes and approaches

Reading models are detailed representations and descriptions of reading theories that explain what reading includes and how reading works. Most of these models are based on empirical reading comprehension studies that understand the nature of reading abilities and predict future studies in relevant areas. The following sections review the literature on cognitive processes, how reading works, and empirical reading models and approaches.

Cognitive processes: How reading works

Researchers on reading comprehension have different ways of presenting reading processes (Baddeley, 2015; Grabe, 2009; Grabe & Stoller, 2020; Gough, 1972; LaBerge & Samuels, 1974; Rumelhart, 1985). For example, Gough (1972) provided a complete information-processing account of reading comprehension. In Gough's view, reading comprehension is a sequential set of transformations from lower-level sensory information to higher-level encodings. LaBerge and Samuels (1974) proposed a theory of reading comprehension that consists of three memory systems, namely, visual memory system, phonological memory system and semantic memory system, to accommodate different input representations. Just and Carpenter (1980) drew a schematic diagram of significant processes and structures in reading comprehension. Rumelhart (1985) is another representative scholar supporting the cognitive perspective of reading comprehension. He claimed reading 'begins with a flutter of patterns on the retina and ends (when successful) with a definite idea about the author's intended message' (Rumelhart, 1985, p. 722). Pressley and Afflerbach (1995)

argued that three interplaying activities are performed during reading comprehension: comprehending, evaluating, and monitoring, which characterises meaning construction before, during, and after reading. This framework is consistent with the established theories of metacognition about reading (Baker & Brown, 1984; Paris & Winograd, 1990) and the three-dimension concept of metacognitive awareness: planning, evaluating, and monitoring (Brown, 1980; Garner, 1987). This study will focus on Grabe and Stoller's (2020) process.

Grabe (2009) classified reading processes into lower-level and higher-level abilities. Both processes occur in working memory. Grabe and Stoller (2020) illustrated that lower-level processes include automatic word recognition and lexical access, syntactic parsing, and semantic proposition formation. Higher-level processes involve processes of text representation, situation models of reader interpretation, executive control processes, and strategic processing (strategies). In other words, higher-level processes are closely tied to specific techniques that the reader consciously employs to obtain meaning from the text, e.g., finding the main idea, integrating meaning across sentences, inferencing, comprehension monitoring and goal setting. They outlined the ways that reading comprehension processes are likely to work for skilled readers, assuming a purpose of general comprehension of a longer text, like when a reader reads a book at night before going to bed (Grabe, 2009; Seidenberg, 2017; Stafura & Perfetti, 2017; Willingham, 2017). They also noted that people who are good at reading break down this explanation into lower-level, higher-level, and general cognitive processes. The first two groups of processes are common metaphors. Lower-level processes are the more automatic linguistic processes, usually thought of as more skill-based.

Higher-level processes are generally considered comprehension processes that use more of the reader's background knowledge and inferencing skills. They illustrated that information from lower-level and higher-level processes is part of working memory processing. Working memory has a significant influence on reading development and reading comprehension skills. General cognitive processes (and knowledge storage resources) are genetically coded abilities for mental processing of all types. Most can be viewed as parts of humans' more primal survival mechanisms

(Eysenck & Keane, 2015; Seidenberg, 2017). Indeed, cognitive abilities underlie the development of all learning, including fluent reading. These underlying cognitive abilities are consistently used across all languages during reading and reading development. Working memory and background knowledge are two of the cognitive processes and resources that have been shown to impact reading comprehension. These abilities are vital components of processes for information retrieval from long-term memory and linguistic comprehension process (Ellis, 2015; Eysenck & Keane, 2015; Kong, 2018; Seidenberge, 2017; van den Broek, Mouw & Krall, 2016; Westby, 2014).

Moreover, the view of reading suggested by Gough and Tunmer (1986)is based on the idea that reading is a combination of word decoding abilities (D) and comprehension ability (C). The model can be expressed in an equation: $R = D \times C$, suggesting that reading (R) is the product (or interaction) of decoding abilities (D) and comprehension abilities (C), the former being bottom-up processing and the latter being top-down processing (Adolf, Catts, & Little, 2006; Chen & Vellutino, 1997; Gough, Hoover, & Peterson, 1996; Gough, Juel, & Griffith, 1992; Grabe, 2009; Hoover & Gough, 1990; Hoover & Tunmer, 1993)

To sum up, the literature reviewed the relationships among lower-level processing, higher-level processing, working memory, background knowledge, and long-term memory knowledge resources, as well as general cognitive processes that promoted reading comprehension. This present study focused on Grabe and Stoller's (2020) components of reading processes.

Reading models and approaches

Many researchers attempt to create a general understanding of the reading comprehension processes using some reasonable mental theory. Two kinds of reading models have existed since the 1960s: process models and componential models. The process models comprise several related and interconnected activities and several non-sequential processing activities (e.g., Gough, (1972) Just & Carpenter, (1980) Rayner & Pollatsek, (1989). By contrast, the componential model describes the components involved in the reading process but does not explain how these

components are related (Urquhart and Weir, 1998). Weir and Porter (1994) identified three types of componential theories for reading: “unitary,” “multi-divisible,” and “bi-divisible.” According to componential theories, reading comprehension is the product of language comprehension and decoding.

Several studies support the unitary componential model (Spearitt, 1972; Lunzer, Waite & Dolan, 1979; Rosenshine, 1980; Carver, 1992), and Perfetti (1977) has proposed two-component or bi-divisible models of reading. Specifically, Perfetti (1977) proposed a reading model that results from language comprehension and decoding. This technique focuses on carefully deciphering the words and phrases, with little attention devoted to speed reading. Gough and Tunmer (1986) also advanced a bi-divisible view of reading, arguing that it results from decoding and comprehension (i.e., R=D*C). Similarly, Hoover and Tunmer (1993) argued that comprehension required the comprehensive collection of whole meanings from the text rather than skimming, which is the process of reading a text selectively to extract the essential concepts. Finally, Gough and Tunmer (1986) also demonstrated that a person’s reading ability could be measured by assessing their decoding and comprehension abilities.

Process models include bottom-up, top-down, and interactive (Barnett, 1988). These paradigms have Goodman’s (1967) “psycholinguistic” model, Smith’s (1971, 2012) “top-down” model, Gough’s (1972) “bottom-up” model, and Stanovich’s (1980) “interactive approaches” second language (L2) or foreign language (FL) reading research.

The first model, bottom-up processing, is used in phonics. This model assumes that the reader interprets letters, words, phrases, and sentences before interpreting the text. A reader learns letter/sound relationships, decodes words, reads sentences, and focuses on the text’s meaning (Reyner, 2008). This model is sometimes called a text-based process. The second, reader-based process, is commonly described as a “top-down” process. The reader employs higher-order concepts like knowledge of the world or a specific situation and focuses on whole texts like paragraphs and sentences. So, the reader studies letters, words, phrases and grammatical patterns in the texts.

The third is the interactive reading model, which combines bottom-up and top-down processing (Rumelhart, 1977; Stanovich, 1980). To read is to see patterns on the retina and then understand the author's message (if successful). The model has two interactions (Grabe, 1991): reader-text interaction and reader-skill interaction. So far, many L2/EFL researchers have focused on the general interaction in which readers construct text meaning using textual and background knowledge. However, cognitive and educational psychologists frequently highlight the relevance of interconnecting skills while reading.

Grabe and Stoller (2020) categorised three models and an approach to reading. The three models are the Simple View of Reading Model (Anderson et al., 2016; Jeon & Yamashita, 2014; Kim, 2017; Schwanenflugel & Knapp, 2016; Verhoeven & van Leeuwe, 2012), the Construction-Integration Model (Kintsch, 1998, 2012), and the Landscape Model (van den Broek et al., 1999). The approach in reading is the Reading Systems Framework approach (Perfetti & Stafura, 2014). This approach explores many factors that can impact reading comprehension and lead to differences in reading outcomes (Grabe & Stoller, 2020).

According to Grabe and Stoller (2020), the Simple View of Reading Model generally combines word recognition and language abilities. The Construction-Integration Model (Kintsch, 1998, 2012) of comprehension focuses on cognitive processes that generate understanding. The Landscape Model was proposed by van den Broek, Young, Tzeng, and Linderholm (1999) and Yeari and van den Broek (2011), focusing on the relationship between comprehension processes and the resulting network of ideas created and updated over real-time during reading. Grabe and Stoller (2020, p.77) also suggested that creating specific materials to collect data is vital in research. Students needed to be recruited to do experimental tasks, and the tasks had to be carried out precisely in ways that did not cause unexpected errors in data collection.

A learner's target language competence and vocabulary, topic understanding, and reading practices may influence comprehension of English literature. According to Zare-ee (2007), reading strategy is an essential variable in text comprehension, and

readers adapt their reading strategies to the texts they read. Reading strategies include cognitive and metacognitive strategies (Zare-ee, 2007).

English as a Foreign Language (EFL) or second language (L2) learning strategies are specific activities, behaviours, stages, or approaches that are frequently and purposefully employed to aid students in comprehending, internalising, and using the language (Oxford, 2011, 2017). The term “reading strategies” refers to the mental activity that readers engage in to derive meaning from a text to achieve reading goals(Erler & Finkbeiner, 2007; Wang, 2016). According to Nadea, Jumariati, and Nasrullah (2021), reading comprehension strategies can be bottom-up or top-down. Reading techniques can also reveal how readers conceptualise a task, what textual signals they pay attention to, how they make sense of what they read, and what they do when they do not understand a text (Othman et al., 2014; Song, 1998). Reading strategies must be employed to extract maximum information from the text to improve reading skills. Alderson (2000) underlines the need for effective readers to use reading strategies flexibly. Indeed, a reader’s ability to comprehend a text depends highly on their strategies.

The reviewed literature about reading processes and approaches has important implications for the current study. First, the primary goal of an assessment task is “to collect relevant information for purposes of making inferences or decisions about individuals” (Alderson, 2000, p. 203, 2008, 2015). This can be achieved by characterising the construct of reading accurately and eliminating irrelevant factors in choosing text materials and test methods (Urquhart & Weir, 1998). With a detailed introduction on how cognitive reading processes are defined and how several relevant reading models interpret and describe the reading comprehension process, the construct definition, models, and an approach to reading concerning this study are in order. In the present study, reading comprehension is viewed as a constructive process in which the text, the reader, and the context interact with one another (Grabe, 2009; Grabe & Stoller, 2020). In this process, both top-down processing and bottom-up processing are involved in which the former can be reflected through readers’ integration of their background knowledge and prior experience into their reading comprehension, whereas the latter is mainly demonstrated through readers’ decoding

of the text at the word level using their lexico-grammatical knowledge (Aryadoust & Baghaei, 2016; Gough & Tunmer, 1986; Jeon & Yamashita, 2014; Kintsch, 1988; Samuels & LaBerge, 1983; Zheng et al., 2023).

Second, the previous literature reviewed here can help to better understand the cognitive processes that L2 and EFL readers engage in while reading texts in English. For example, previous research has shown that the combination of readers' automaticity in word recognition (i.e., the core of decoding abilities) and their abilities lead to reading comprehension (LaBerge & Samuels, 1974; Samuels & LaBerge, 1983; Gough & Tunmer, 1986; Grabe & Stoller, 2020). This provides the theoretical basis for the model in the later part of this study. Furthermore, the interactive models proposed by Rumelhart (2004) and Stanovich (1980) claim that if readers have insufficient vocabulary or language proficiency or fail to achieve reading automaticity (Pressley, 2006), they could use other sources to understand the text. Based on Grabe and Stoller (2020), the development of cognitive reading processes on individual reader processing and the three models and an approach explain how readers achieve some successful reading comprehension levels. They argued that no model could fully explain how readers achieve reading comprehension in varying contexts. L2 and EFL readers with few cognitive resources in vocabulary and language proficiency may understand the text and topic or rely on inference-making more than first language readers. More importantly, they may use more strategies than first language readers to deduce the meaning from the text (Pressley, 2006; Webb and Chang, 2015). These processes provide the theoretical basis for the model of EFL reading in the present study.

To summarise, the reviewed literature on reading processes and approaches provided significant implications for exploring EFL readers' reading comprehension processes, especially in taking the EFL reading comprehension test.

2.3.3 Factors affecting reading test performance

Numerous language testing (LT) scholars have contributed to our understanding of the elements impacting language test performance and how much a single component may account for test performance variance. Indeed, LT researchers have long been

interested in understanding the impact of individual traits on success in language tests (Kunnan, 1995; Phakiti, 2003, 2008, 2016; Purpura, 2014, 2016). Specifically, it has been shown that strategy usage, one of the individual characteristics, explains a significant portion of the diversity in test scores (Damankesh & Babaii, 2015; Phakiti, 2003, 2008, 2016; Purpura, 1997, 1999; Song, 2005; Song & Cheng, 2006; Zhang, Goh, & Kunnan, 2014; Zhang, 2018).

Test-takers' characteristics

Before administering a test, testers often solicit input from a representative sample of essential stakeholders, notably test-takers (Bachman & Palmer, 1996, 2010; Messick, 1996). Unfortunately, it is sometimes challenging to identify the true nature of test takers' language abilities and interpret test scores due to the influence of test-taker characteristics. Previous research has attempted to examine the impact of test-taker factors on test performance. These factors include capacity, academic and cultural background, pragmatic knowledge, background information, career, the effects of L1, age, gender, personal characteristics, and learning style (Bachman, 2000, 2010; Kunnan, 1994; 1995; Lumley & Sullivan, 2005; Sasaki, 2000).

Other essential factors include test-taking strategies (Cohen, 2006), test preparation (Xie & Andrews, 2012), and affective factors (Jin & Cheng, 2013). Test-taking strategies have been classified into three categories (Cohen, 2006): 1) language learner strategies, 2) test management strategies, and 3) test wiseness strategies. Rubb et al. (2006) also distinguished between two types of test-taker strategies. First, test-takers may devise strategies to deal with the skills assessed by the testing. Those strategies are thought to be constructs that influence score interpretation. Second, construct irrelevant strategies are used to cope with the cognitive effort produced by task characteristics.

Previous research has also examined whether a specific activity or test method evokes the appropriate set of skills for the context (Schwanenflugel and Knapp, 2016). Other studies have focused on test improvement by examining test-takers strategy use (Park, 2009). For example, Cohen and Upton (2006) used verbal protocol analysis to investigate the construct validity of the TOFEL iBT reading portion to determine

whether the test correctly assesses test takers' academic reading ability. Interestingly, test-takers continued to view the reading task as a testing activity rather than an academic one.

Xie and Andrews (2012) also investigated the link between test design and usage, test preparation, and test performance using a questionnaire and structural equation modelling. The results indicated that test design affected test preparation and that test preparation had a negligible effect on score improvement. Finally, Jin and Cheng (2013) examined how test anxiety and learning desire affected test takers' overall test performance. A regression analysis revealed that test takers' perceived importance of the test affected their motivation and anxiety throughout the test. Thus, the present study used a structural equation model to explore the relationship between cognitive and metacognitive strategies used by EFL high school students on reading performance (Han, 2018, Wang, 2016).

Test-takers strategies and processes

Strategic competence is "the capacity to put the components of language competence into practice in contextualised communicative language usage" (Bachman, 1990, p.84). It contributes to test score variation as it influences one's ability to employ language use strategies (Bachman & Palmer, 1996; Bachman, 1990, 2010). Language use strategies are commonly used in L2 testing situations (Cohen, 2011). L2 test-takers may use these strategies to complete test tasks by accessing information and abilities from long-term memory, often gained via language learning strategies in general situations (Phakiti, 2003). The current study defined strategy usage as the conscious ideas and behaviours L2 test-takers employ when executing specific language tasks in test situations (Cohen, 2007, 2011; Phakiti, 2003).

According to Bachman and Palmer's (1996, 2010) theoretical framework of language usage, test-takers' cognitive and metacognitive strategy use affects their test performance. Cognitive strategy use refers to individuals' actual plans to accomplish specific tasks during language use or in testing settings. In contrast, the use of metacognitive strategy "serves as a managerial function during language use" (Bachman & Palmer, 2010, p.49). Purpura (1999) used principles of cognitive

psychology to explain how strategies function at various levels of information processing in test situations and how test takers employ cognitive and metacognitive strategies to perform language test tasks. After incoming information enters the processing system, cognitive strategies are actively involved in the processes of selective perception, storage, retrieval, and response organisation. These cognitive processes are regulated by metacognitive strategies, which are mental processes associated with task planning before the task, monitoring during the task, and evaluation following the task. In brief, cognitive strategy use includes comprehension, memory, and retrieval, whereas metacognitive strategy use is based on mental processes associated with task planning, monitoring, and evaluation (Purpura, 1999).

Purpura (2014) later extended Gagné et al.'s (1993) model by including emotional strategies to describe the interaction between strategic competence and L2 processing in evaluation. Affective strategies that regulate motivation and emotion in language use (Oxford, 2011), which were not included in Gagné et al.'s (1993) information processing model, are critical components of several widely used strategy taxonomies (O'Malley & Chamot, 1990; Oxford, 1990, 2011) and are recognised as effective strategies for improving L2 test-takers' test performance (Phakiti, 2007). Purpura's (2014) model states that a test-taker follows several processes: comprehension, memory and retrieval, and output. Cognitive, metacognitive, and affective strategies all play a role in these processing stages, generating the correct solution to the test problem and influencing test performance.

Based on theoretical models of language use (Bachman & Palmer, 1996, 2010; Bachman, 1990) and cognitive psychology theory (Gagné and Spalding, 2013; Paris & Winograd, 1990; Wu & Barsalou, 2009), language testing researchers conducted a series of empirical studies to determine how test takers' strategy use is related to their performance on L2 English reading tests (Phakiti, 2003, 2008; Zhang et al., 2014; Zhang & Zhang, 2013; Zhang, 2018). First, Phakiti (2003) examined the relationship between L2 test takers' strategy use and their performance on an English reading test, identifying both weak and positive correlations between cognitive and metacognitive strategies and reading test performance. In a follow-up study, Phakiti (2008) found that metacognitive strategy use indirectly affected reading test performance via

cognitive strategy use. Specifically, the use of cognitive strategies directly influenced lexico-grammatical reading ability, and the employment of metacognitive strategies had a significant effect on cognitive strategy use. Later, Zhang et al. (2014) showed that cognitive and metacognitive techniques influenced L2 test takers' lexico-grammatical reading ability, as measured by the College English Test Band 4 (CET-4) reading subtest. They concluded that cognitive and metacognitive strategies might unify to improve test takers' reading test performance regardless of their natural characteristics. Together, these studies indicate that cognitive and metacognitive strategies are two critical strategy variables that influence test performance (Phakiti, 2003, 2008; Zhang et al., 2014; Zhang & Zhang, 2013; Zhang, 2018).

Cohen (1998), influenced by Fransson (1984, p.64), argued that "test-takers may not move through the text but rather around it", which implies that test-taking strategies also include language use and test-wiseness strategies. Indeed, according to Cohen (2007), test-taking strategy research can shed light on (a) the nature of low-level versus higher-level processing during a test, (b) the effect of using authentic versus inauthentic passages in reading tests, (c) whether strategies used during L2 test-taking are typical of L2 use, (d) the most and least effective strategies for test success, and (e) the degree to which different strategies contribute to test success. However, research on test-taking strategies has focused so far on test development rather than on validating strategic competency theory. Indeed, strategy data are typically not obtained in real-world high-stakes testing settings (Cohen, 2007), and the strategies used to respond to tests in high-stakes environments differ from those identified in experimental studies because, in experimental studies, there is no penalty for not replying to test items (Cohen, 2007).

Test-taking strategies

Test-taking and reading strategies must be clearly defined since they have many similarities and might be mistaken in reading assessment. First, while test-taking strategies are not language-specific, each language competency has its own set of strategies. Second, test-taking strategies are used when readers are given a test or assessment assignment and, therefore, are "motivated by the test questions" (Farr, Prichard, & Smitten, 1990, p. 218). By contrast, reading strategies are used anytime

readers engage in a reading activity and, therefore, “are connected to text comprehension” (Singhal, 2001, p. 1). Learners will almost certainly employ reading-related strategies to pass a reading test successfully. However, that does not mean all reading test approaches are connected to reading (Allan, 1992; Singh, 2021). Interestingly, Cohen and Upton (2006) found that their sample of 32 test-takers used test-taking strategies significantly more frequently than they used reading strategies. This is not to deny the importance of reading strategies, such as summarisation (Szűcs & Kövér, 2016). Still, some formats, such as a multiple-choice reading assignment, involve specific test-taking strategies and a “constant, purposeful, and linear participation in problem-solving activities” (Rupp et al., 2006).

In their revised strategic competence model, Bachman and Palmer (2010) highlighted the importance of performance evaluations, including monitoring necessary and available exam performance (Bachman & Palmer, 2010). Using this technique, test takers can “diagnose probable reasons of the problem such as difficulty completing a test task owing to a lack of prior knowledge and change the communication objective, the method for reaching that goal, or both” (Bachman & Palmer, 2010). Metacognitive research also demonstrates the need for self-monitoring and self-evaluation of current thoughts or behaviours (Alexander, 2013; Efklides, 2011; Schraw, 2009). However, additional language testing and assessment research is needed to understand how well performance appraisals predict actual test performance and the extent to which these evaluations help test-takers respond effectively to test tasks.

Overall, it is clear that several variables impact or contribute to language test performance (Bachman, 2000; Bachman & Palmer, 2010; Purpura, 2014). While target language structures should be the primary factor explaining a test result, other factors (e.g., test method features, test-taker characteristics, and random error) contribute to test score variation (Bachman & Palmer, 2010). The current study focuses on metacognitive strategies (including planning, monitoring, and assessing) for regulating language usage and other cognitive tasks.

Learners use test-taking strategies throughout various forms of language evaluation (Cohen, 1998, 2007) and are used to provide accurate answers on language tests (cf., Cohen, 1986; Cohen & Upton, 2006). Indeed, Cohen (1986) argued that test-takers might correctly answer questions on a multiple-choice reading exam without entirely or even substantially grasping the content. Thus, test-taking strategies might be short (e.g., looking for a clue that connects the question to the reading text) or long (e.g., looking for an indication that connects the question to the reading text or reading the whole text after reading the questions) (Cohen, 1992).

Test-taking strategies are often considered compensatory since they make up for a lack of language abilities. Cohen and Upton (2006) argue that test-taking strategies may be described using Bachman and Palmer's strategic competency framework (1996, 2010). This framework shows test responders engage in four metacognitive processes when responding to a testing task. Test-takers begin by assessing the task's objectives and determining which aspects of knowledge it requires (assessment). They then select what to do in response to the task (goal setting), relate the information needed to their prior knowledge, and decide how to act (planning). Finally, they put what they have agreed to do into action via the actual provision (execution). Two test takers with the same degree of language proficiency can be distinguished by their level of engagement in these processes and their management of test-taking strategies during the test (Bachman & Palmer, 1996, 2010).

Prior research on reading strategies among L1 and L2 readers at various competence levels and across multiple learning situations demonstrates the critical importance of such strategies in developing required reading abilities (e.g., Alfassi, 2004; Mokhtari & Sheorey, 2008; Pressley & Afflerbach, 1995, Zhang, 2018). More recent research has found that prior knowledge may optimise strategy use to promote comprehension of reading tasks (Mokhtari et al., 2018).

Test-method features

The study of test-method characteristics, including testing processes across language abilities, has been a persistent focus of LT research (Bachman, 2000). For instance, Kobayashi (2002) found that text type and response style affect the reading

comprehension performance of L2 learners with varying degrees of proficiency. Upshur and Turner (1999) also showed that speaking test performance depends on the type of task used. Other studies have also investigated the impact and role of raters on speaking (Bonk & Ockey, 2003) and writing test performance (Weigle, 1998), as well as vocabulary and reading performance in multiple-choice and multiple true-false tests (Dudley, 2006). Various test types are used to measure reading comprehension in the literature, and assessments are also among the most popular classroom methods in foreign language reading classes.

Multiple-Choice Items

A multiple-choice test item is "a test item in which the test taker must select the proper option (the key) from many offered options" (Davies, Brown, Elder, Hill, Lumley & McNamara, 1999, p.124). When written correctly, multiple-choice questions are the preferred method to assess reading comprehension because their scoring is consistent, fast, and inexpensive. According to Heaton (1988), multiple-choice questions are reliable, objective, easy to score and testee-friendly. Thus, multiple-choice is the most commonly used format on high-stakes reading comprehension exams (Campbell, 1999; Phakiti, 2003).

Completion Items

The term "completion item" refers to "a test item or question that requires test takers to finish a sentence with a single word or phrase" (Mousavi, 1999, p. 53). It requires only one answer after a phrase (McMillan, 2004). These items have several advantages, including they are easy to construct, a short response time allows a good sampling of different facts, guessing contributes little to error, and high-reliability scorer scored more quickly than open-ended or essay items. They provide more valid results than a test with an equal number of selected response items (e.g., multiple-choice). The answer required may range from one word to one or two sentences (Heaton, 1988).

Reading to Fill in the Gaps

There is no easy solution to determine which type of reading comprehension test to employ. However, exercises such as gap-filling may be used to assess students'

comprehension and inferencing ability based on textual information. Yamashita (2003) showed that gap-filling exams are acceptable for students' reading comprehension since they examine students' text-level knowledge and discriminate between competent and less experienced readers. However, it is critical to distinguish between gap-filling and cloze activities (Alderson, 2000). Cloze exercises include the methodical obliteration of words from the text. According to Grabe (2009), cloze assessments are tasks that have "random n-th word deletion (every sixth or seventh word)" (p. 359). By contrast, gap-filling activities do not involve systematic word deletion, making them more helpful reading comprehension markers. Additionally, Alderson (2000) argued that gap-filling tasks could be used to measure reading comprehension, but cloze exams do not provide information on the test takers' reading comprehension.

According to the gap-filling test, it is more difficult than the cloze test, but the context effect was larger for the gap-filling. He found that test-takers must understand the context to absorb semantic and linguistic information to do well on gap-filling tasks. However, the cloze test did not require test takers to grasp the context; instead, they may fill in the blanks using local cues. Nevertheless, the gap-filling test assists teachers in diagnosing and addressing specific types of language items. These tests can reveal whether students are struggling with a particular aspect of languages, such as parts of speech or text comprehension.

Gap-filling activities also differentiate between skilled and less skilled readers (Yamashita, 2003) and can be used to achieve various objectives. For instance, these tasks can test a reader's fundamental reading comprehension or their ability to infer, synthesise information, recognise major concepts or details, and compare or contrast material. By contrast, cloze exams can only reveal the student's ability to perceive and respond to local syntactic restrictions (Alderson, 1979). Hedgcock and Ferris (2009) state that the usefulness of cloze activities is limited since they do not provide detailed information about students' comprehension of the material.

Reading–Writing Integration

Test developers incorporate writing into reading comprehension assessments through summaries, essays, or reading-to-write synthesis. Perfetti, Rouet, and Britt (1999; see also Zhang, 2013) defined reading to integrate information as a process in which students synthesise information from multiple sources and compile data from various sections of an extended text, for example, by bringing together complex and lengthy information from a textbook chapter. Although integrating reading and writing in assessment appears to contradict the initial objective of measuring reading as a distinct ability, it has become evident over time that reading and writing are overlapping talents (Shanahan & Lomax, 1986; Grabe & Zhang, 2016). Indeed, reading affects writing development, and writing ability affects reading development (Graham et al., 2017).

Reading to integrate, or reading to produce a synthesis, is distinct from summary writing. When creating a synthesis, the reader/writer must arrange textual material distinct from the information supplied in the source texts (Grabe, 2009). The reader goes beyond the material's fundamental knowledge and must synthesise information, infer, make inferences, compare and/or contrast texts, and construct arguments as part of the synthesis process (Grabe & Zhang, 2013; Zhang, 2018).

Test method and test-takers' strategy use

In 1984, Shohamy first evaluated the influence of the multiple-choice and short-answer test methods on reading comprehension. It was shown that each testing technique presented the test taker with a varying degree of difficulty, and both approaches substantially influenced student reading comprehension scores. A few years later, Gordon (1987, in Cihangirli 2000; Karacaer 2001) also examined the multiple-choice and open-ended techniques and found that the questions include information to help readers comprehend the content. Thus, not only does the test format affect reading performance, but the test task also impacts the meaning that the test taker develops from the stimulus text (Assiri, 2011; 2016; Cohen & Upton, 2006; Jung, 2017; Kashkouli & Barati, 2013; Khoshsima, Amin, et al., 2018; Powers & Wilson Leung, 1995; Wu, Chen, & Stone, 2017)

Studies on multiple-choice reading tasks have found that respondents, particularly those with low proficiency, demonstrated a notable tendency to guess the key answers from the options by matching the content of the item stem and alternatives to that of the passage without understanding the text (Farr et al., 1990; Rupp et al., 2006). Some respondents also eliminated what they perceived to be non-key answers among the options (Storey, 1997). Rafi and Islam (2017, p. 46) classified test-taking strategies into seven categories: option selection, question rereading, option comprehension, answer-checking, option consideration, cognitive strategies, and clue-finding strategies. Despite popular belief, test-takers can employ the same test-taking strategies on multiple-choice tests regardless of whether the texts are familiar to them (Lee, 2015). For example, Sukying, Wan-arom and Phusawisot (2012) analysed English headwords utilised in ELT coursebooks and O-Net exams using lexical perspective concepts. They found that words in the ELT books successfully prepared learners for the English O-net tests regarding vocabulary size. However, according to text coverage, which indicates the readability of the text, they were not regarded as good texts for independent reading since they were graded at an instructional level for unassisted reading.

It has been argued that test-taking methods are as crucial to test performance as knowledge of the subject content (Dodeen, 2015; Langerquist, 1982). This is not to say that these strategies may replace comprehension of the contents or test preparation; students who possess such approaches can maximise their outcomes given their knowledge and test preparation level. Indeed, knowing how to study and prepare for the test is one of the most crucial test-taking strategies. Students can also use testing strategies to help them apply what they have learned in class (Khoshsima & Mousaei, 2018; McLellan & Craig, 1989). Students who possess or learn test-taking strategies or abilities will improve their testing ability and, as a result, their academic achievement. Indeed, students who use test-taking strategies have better attitudes towards tests, lower levels of test anxiety, and higher test scores. Moreover, even students knowledgeable about the subject may perform poorly on tests due to a lack of test-taking skills (Sweetnam, 2003).

Bachman and Palmer (2010) refined the initial framework of language ability and noted that the characteristics of test-takers or language users are essential to language ability. Thus, these factors might affect the EFL reading performance of high school students' cognitive and metacognitive strategy use. The following section reviews studies on strategy use and EFL reading test performance.

2.4 Previous studies on strategy use and EFL reading test performance

The literature review section underscores the significance of cognitive and metacognitive strategies within the Communicative Language Ability (CLA) framework proposed by Bachman and Palmer (1996), as well as their influence on English as a Foreign Language (EFL) reading processes and approaches, as detailed by Grabe & Stoller (2020) and Phakiti (2007). These strategies are pivotal in explaining the variability observed in language performance, as they directly impact how test-takers interact with language tests.

Bachman and Palmer's (2010) CLA framework posits that language testing should assess linguistic competence and the ability to employ cognitive and metacognitive strategies effectively. These strategies facilitate information processing, storage, and retrieval, thus playing a crucial role in successful test-taking. Cognitive strategies involve direct interaction with the material, such as making inferences or summarizing information. In contrast, metacognitive strategies manage these cognitive processes, including planning, monitoring, and evaluating one's understanding and performance.

Phakiti (2003) emphasizes the context-dependent nature of strategy use, suggesting that the effectiveness and selection of cognitive and metacognitive strategies can vary based on the test taker's characteristics, the testing environment, and the specific demands of the test tasks. This highlights the need for a nuanced understanding of reading comprehension and strategy use across different contexts to optimize language testing and teaching practices.

Moreover, individual learner factors such as language proficiency, gender, culture, motivation, and anxiety are critical influencers of strategy use. These factors can determine the test-taker's approach to the test, influencing decisions such as whether

to skip questions to save time or employ specific strategies like inference-making based on one's strengths in areas like morphology.

The literature review stresses the importance of cognitive and metacognitive strategies and EFL reading processes in shaping language testing performance. It calls for a comprehensive approach that considers the diverse factors affecting strategy use and the complex interplay between these strategies and language proficiency. This approach can inform the development of more effective language teaching methodologies and assessment tools that cater to the varied needs of learners and accurately measure their language competence and strategic ability.

2.4.1 Studies on cognitive and metacognitive strategy use and language testing performance

The body of research on strategic competence in language testing, mainly as conceptualized by Bachman and Palmer (1996, 2010), underscores the intricate relationship between cognitive and metacognitive strategy use and language test performance. Studies by researchers like Purpura (1999), Phakiti (2003b, 2006a, 2007, 2008a), and Song (2004, 2005) have contributed significantly to understanding this dynamic.

Purpura (1999) pioneered the empirical investigation into this relationship by applying structural equation modelling (SEM) to assess how learners' strategy use affects their performance on language tests. His findings revealed that language test performance could be primarily explained by two underlying abilities: reading and grammar. Cognitive strategies were identified as multidimensional, encompassing comprehension, memory, and retrieval processes, while metacognitive strategies were seen as unidimensional, focusing on assessment procedures. Importantly, metacognitive strategies were found to significantly impact cognitive processing, thereby influencing language test performance.

Phakiti's series of studies (2003b, 2006a, 2007, 2008a) further explored these relationships, employing both SEM and exploratory factor analyses to delve into the nature and impact of these strategies on EFL reading test performance. His research corroborated and expanded upon Purpura's findings, demonstrating that cognitive and metacognitive strategies are positively associated and significantly contribute to test

performance, with metacognitive strategies playing a crucial role in modulating cognitive strategy effectiveness.

Song's work (2004, 2005) utilized regression analysis to examine the impact of strategy use on test performance among Chinese test-takers, highlighting the positive predictive power of monitoring strategies on scores. This series of studies collectively emphasizes the complexity of strategic competence, illustrating how cognitive, metacognitive, and even affective strategies interact within the language learning and testing process.

The accumulated evidence suggests that strategic competence involves a sophisticated interplay of cognitive and metacognitive processes that significantly influence language test outcomes. This body of work underscores the necessity of broadening the understanding of strategic competence to include a wide range of cognitive, metacognitive, and affective strategies as they collectively contribute to successful language use and test performance. The current study aims to further dissect these dynamics by examining the specific roles of cognitive and metacognitive strategies in EFL reading comprehension, offering insights into how these strategies can be effectively harnessed to improve educational and assessment practices in language learning contexts.

Recent studies highlight the critical role of cognitive and metacognitive strategies in enhancing reading comprehension and language learning outcomes across diverse educational contexts. Semtin and Maniam (2015) focused on Malaysian secondary students, uncovering a balanced use of cognitive (like resourcing and summarizing) and metacognitive strategies (such as monitoring and evaluation) to bolster comprehension. Similarly, Osuji (2017) found in Nigeria that both cognitive and metacognitive strategies, when used together, significantly boosted ESL learners' reading comprehension, with metacognitive strategies alone making a unique, significant contribution.

Saks and Leijen (2018) reported a direct correlation between using cognitive strategies and learning outcomes among upper-secondary students, supported by structural equation modelling showing direct and indirect effects of cognitive and metacognitive strategies on test scores, respectively. Zhang (2018) further explored

this dynamic within the context of the CET-4 Reading subtest for Chinese college students, identifying a comprehensive array of strategies employed by test-takers that collectively improved performance, emphasizing the intertwined nature of cognitive and metacognitive strategies in practical language test situations.

These findings underscore the importance of strategic engagement with texts, highlighting the impact of both cognitive and metacognitive approaches on improving students' reading comprehension and overall language proficiency. The research suggests that educators should encourage the development of both types of strategies to aid in language learning and comprehension tasks.

The synthesis of findings from research by Osuji (2017), Semtin & Maniam (2015), Saks & Leijen (2018), and Zhang (2018) reveals a clear connection between the use of metacognitive and cognitive strategies and improved test performance. These studies collectively illustrate that cognitive strategies directly influence learners' ability to comprehend reading material, while distinguishing between cognitive and metacognitive strategies can be complex in real-world language situations. Further insights from literature (Alderson, 2005; Bachman, 1990; Chamot, 2005; Oxford, 1990; Phakiti, 2003) underscore the interplay between metacognitive and cognitive strategies, especially in second language (L2) reading contexts, highlighting the pivotal role of metacognitive strategies in guiding cognitive strategy use.

Research into reading strategies emphasizes the significance of strategic interaction with texts for successful reading comprehension, pointing out that effective L2 readers utilize appropriate strategies to enhance text understanding. Conversely, less successful readers often lack these metacognitive strategies, facing difficulties monitoring their comprehension and employing practical reading approaches.

Despite the wealth of studies focusing on tertiary education, there is a noted scarcity of research examining the impact of cognitive and metacognitive strategy use on reading test performance among high school students. Addressing this gap, the current investigation extends the exploration of cognitive and metacognitive strategy use in EFL reading test performance within the high school context, adopting frameworks from Bachman & Palmer (1996, 2010) and Phakiti (2007) on language testing. This approach aims to deepen the understanding of how these strategies contribute to EFL

learners' reading success, emphasizing the need for further examination in secondary educational settings to enhance educational strategies and learner outcomes.

2.4.2 Research on cognitive and metacognitive strategies and Thai EFL reading

The research on reading strategy use among Thai EFL learners highlights the importance of a multifaceted approach to teaching reading comprehension. Studies by Akkakoson and Setobol (2009) and Kasemsap and Lee (2015) provide insight into the preferences and effectiveness of various reading strategies among tertiary-level students and vocational college students in Thailand, respectively.

Akkakoson and Setobol (2009) focused on undergraduate students at King Mongkut's University of Technology North Bangkok, investigating the use of traditional, cognitive, and metacognitive strategies in reading English texts. Their study found that conventional strategies were most prevalent among the students, both before and after instruction. This may reflect a widespread familiarity with the bottom-up model of reading instruction in Thailand. Despite this, the study observed an increased awareness of cognitive and metacognitive strategies among students, suggesting that explicit teaching of these strategies can enhance students' reading comprehension skills. The researchers proposed a teaching model that integrates all three types of strategies, emphasizing preparation with metacognitive strategies, engagement with the text using a mix of strategies, and reinforcement of comprehension and vocabulary through cognitive and traditional strategies.

Kasemsap and Lee (2015) further explored the use of reading strategies among Thai vocational college students with varying levels of English proficiency. Their study found no significant overall difference in strategy use between higher and lower-proficiency students. Still, it did reveal that higher-proficiency students tended to use retrieval strategies more often, while lower-proficiency students relied more on memory strategies. This suggests that proficiency level influences the types of strategies students are inclined to use, with higher proficiency students more likely to engage in cognitive and metacognitive strategies that facilitate deeper comprehension and retention of information.

Both studies underscore the need for English reading instruction in Thailand to move beyond traditional bottom-up approaches and incorporate a broader range of cognitive

and metacognitive strategies. By doing so, teachers can better support students in developing a more sophisticated set of tools for engaging with and understanding English texts, ultimately leading to improved reading comprehension outcomes. This integrated approach can cater to the diverse needs of students with varying proficiency levels, encouraging more effective strategy use and enhancing overall language competence.

The research collectively explores the nuances of reading and language learning strategies among Thai EFL (English as a Foreign Language) learners across different educational levels, from university students to secondary school attendees (Chutichaiwirath, 2016; Sukying, 2021; Thongwichit, 2018: Wutthisingchai & Stopps, 2018). These studies highlight the significant role of metacognitive awareness and the strategic use of reading and language learning strategies in enhancing reading comprehension and overall language proficiency.

Chutichaiwirath (2016) focuses on the metacognitive awareness of reading strategies among female university students majoring in English. The study underscores the high frequency of problem-solving strategies employed by these students, followed by global and support strategies. It suggests that an enhanced identification and application of various metacognitive reading strategies could improve EFL learners' reading comprehension abilities.

Thongwichit (2018) broadens the exploration to compare successful and less successful readers, pointing out that successful readers adeptly plan, monitor, and evaluate their reading strategies. This contrast with less successful readers indicates a gap not in the awareness but in the effective application of metacognitive strategies, which appears to be a critical factor in reading achievement. Similarly, Wutthisingchai and Stopps (2018) delve into the factors affecting English reading abilities among secondary school students, identifying the nature of the text as a pivotal concern among learners. Their recommendations emphasize the development of reading skills, the importance of making students aware of their reading strategies, and the beneficial role of teachers in activating students' prior knowledge before reading tasks.

Lastly, Sukying (2021) expands the scope to include a broader range of English language learning strategies among first-year university students, highlighting the use of affective and metacognitive strategies alongside cognitive, compensation, social, and memory strategies. This study illustrates that proficiency in language learning correlates with the diversity and appropriateness of strategy use.

Collectively, these studies underline the importance of metacognitive strategy awareness and application in reading and language learning contexts. They suggest a pivotal shift towards fostering strategic, reflective learners who can adaptively manage their learning processes. The implication for educators and curriculum designers is clear. There is a need to integrate strategy training into language learning programs to equip learners with the skills necessary to navigate and excel in their language acquisition journey. This could involve direct instruction on different strategies, opportunities for practice and reflection, and fostering an environment that encourages experimentation and evaluation of various techniques to find the most effective personal learning approach.

The overview highlights a critical research gap in understanding strategy use among Thai EFL learners, particularly at the high school level. Previous studies, such as those by Semtin & Manian (2015) and Saks & Leijen (2018), have explored strategy use in reading comprehension and language learning among university students, with works by Chutichaiwirath (2016), Thongwichit (2018), and Sukying (2021) further delving into the nuances of strategy application in language acquisition and reading proficiency. Despite the depth of research at the university level, the specific interplay between cognitive and metacognitive strategy use and reading comprehension test performance among high school students has remained underexplored.

Addressing this gap, the present study focuses on the high school setting to examine how cognitive and metacognitive strategies influence reading test outcomes, as outlined in Phakiti's (2007) model. By situating the research within this framework, the study seeks to illuminate the specific strategies high school students employ in reading comprehension tests and how they correlate with their performance. This approach fills a critical void in the existing literature. It provides insights that could inform teaching practices, curriculum development, and targeted interventions to

enhance reading comprehension skills among Thai EFL learners at a crucial stage in their language learning journey.

2.5 Summary of the chapter

The current study used an SEM analysis to investigate the nature of cognitive and metacognitive strategy use by analysing the relationships between strategic knowledge and regulation and high school students' EFL reading test performance over two months. The following research questions guide the current study:

1. What is the nature of trait and state cognitive and metacognitive strategies and their relationships to reading comprehension test performance among EFL high school learners?

2. To what extent do cognitive and metacognitive strategies exhibited by traits and states affect Thai EFL high school learners' performance on reading comprehension tests?

3. How stable is trait and state cognitive and metacognitive strategy use on reading comprehension test performance over time?

4. What is the nature of cognitive and metacognitive strategies and their relationships to reading comprehension test performance among Thai EFL high school learners?

5. To what extent do cognitive and metacognitive strategies affect Thai EFL high school learners' performance on reading comprehension tests?

6. How stable is cognitive and metacognitive strategy use on reading comprehension test performance over time?

This chapter presented the constructs of CLA, cognitive and metacognitive strategy use, and EFL reading performance. Furthermore, it reviewed previous studies on strategy use and EFL reading test performance. This literature review highlights a current gap in the literature specifically related to exploring the relationships between cognitive and metacognitive strategy use and reading performance. This chapter also introduced some methodology and research instruments selected for the present study.

CHAPTER III
RESEARCH METHODOLOGY

This study explored the nature of cognitive and metacognitive strategy use by examining the relationships between strategic knowledge and regulation and high school students' EFL reading test performance. The current study adopted Phakiti's (2007) framework to examine cognitive and metacognitive strategy use in high school students in a Thai EFL context. A questionnaire and retrospective interview were used to understand the strategies used in EFL reading test performance. A mixed-methods approach, including Structural Equation Modelling, was used to analyze the data. This chapter outlined the research methodology of the current study, including the research questions, research paradigm, participants and setting, research instruments, data collection procedure, and data analysis.

3.1 Research paradigm

Pragmaticism is a pluralistic approach to research that emphasizes problem-solving over the adoption of a particular methodological approach. Pragmatism is not a paradigm in the classic sense. Instead, this research approach used the methods (quantitative and/or qualitative) most effectively addressing a given research topic rather than adhering to a research philosophy that might have a preconceived notion of what constitutes reality. Pragmatism was supported using various methods, data types, and data analysis to adequately address research questions or problems (Phakiti & Paltridge, 2015). One may argue that this paradigm underpins mixed methods research.

Many academics believed pragmatism could provide a philosophical foundation for the mixed research approach. According to Denscombe (2008) and Mitchell (2018), pragmatism was seen as "the philosophical companion" of mixed research methodology since its fundamental beliefs offered the foundation for combining research techniques. Johnson et al. (2007) also argued that pragmatism was a sophisticated philosophy that provided the epistemology and logic for integrating quantitative and qualitative approaches and methods. Furthermore, according to

Creswell (2014), pragmatism was a philosophy that allowed for mixing paradigms, assumptions, approaches, and data collecting and analysis methods.

The concept of "what works" is central to pragmatism, which is mainly related to the pragmatic truth theory. Rather than being based on assumptions about the nature of knowledge, pragmatism was simply geared toward addressing practical issues in the actual world (Creswell, 2014; Hall, 2013; Shannon-Baker, 2016). This indicated that pragmatism was the crucial driver underpinning "action-oriented" research methods (Cameron, 2011). As such, pragmatism was used to design the current research approach.

3.2 Research approaches

A mixed-methods research design

Applied linguistics research has recently begun incorporating quantitative and qualitative methods into a single study. This type of "mix-methods research" (MMR) claims that combining quantitative and qualitative approaches could improve the quality of research by assisting, complementing, or expanding on the strengths of the other (Creswell & Plano Clark, 2011; Ivankova & Greer, 2015; Riazi & Candlin, 2014; Riazi 2017). Research approaches were strategies or plans that encompass everything from general hypotheses to specific data collecting, analyses, and interpretations (Cresswell, 2014). However, it should be noted that a mixed-methods design was not simply a case of combining quantitative and qualitative data (Dornyei, 2007), and the researcher had to justify why the combination of two different approaches was suitable. The complexity of the problems involved with MMR design was emphasised by Riazi and Candlin (2014). For example, researchers had to address issues such as triangulation, complementarity and the development and sequences of the quantitative or qualitative phases. Traditionally, survey research (Wagner, 2015) typically adopted a quantitative approach, whereas action research (Burns, 2015) adopted qualitative research. However, over recent years, several researchers have gathered both quantitative and qualitative data using the same methods, and, as such, these studies could be considered MMR. Indeed, while a mixed-methods approach might enable researchers to triangulate their findings, data triangulation refers only to

the practice of gathering data from diverse or many sources to acquire a complete knowledge of a subject.

This current study used an MMR design to collect qualitative and quantitative data. A quantitative approach was used to assess the cognitive and metacognitive strategies in EFL reading comprehension using an EFL reading comprehension test and a cognitive and metacognitive strategy use questionnaire. A qualitative approach also included conducting a retrospective interview to gain further insight into the cognitive and metacognitive strategies used in the reading test and data related to participants' strategy use, background information, and personal views.

3.3 Approaches to the Structural Equation Model (SEM)

Structural Equation Modelling (SEM) is a statistical methodology for multivariate analysis using a hypothesis-testing approach. The phrase "latent variable model" generally refers to a model that includes latent variables, multiple indicators, reciprocal causation, simultaneity, and interdependence (Marcoulides & Schumacker, 1996). The SEM approach was used to (1) test substantive theory (hypothesis testing), (2) determine the direct or indirect influence of one variable on another and (3) compare group differences and/or longitudinal differences (Kline, 2016). The SEM procedure involved creating measurement models to define latent variables and then setting up relationships among the latent variables (Byrne, 2010). SEM models differ from path analysis models as SEM models use static variables instead of observed variables and combine a measurement model with a structural model to substantiate theory. In the current study, the causal processes under study were represented by a series of structural equations (e.g. regression), and these structural relations were modelled pictorially for a more precise conceptualization of the nature of strategic competence and language performance under study (Phakiti, 2007).

Advantages of using SEM

While standard statistical techniques (e.g. ANOVA, canonical correlational analysis, and regression analysis) provided valuable information about the nature of strategy usage, they had significant analytical limitations. According to Thompson (1994) and Wilkinson and the APA Task Force on Statistical Inferences (1999), measurement

error impacted parameter estimates in several traditional statistical methods. Indeed, a typical feature of research instruments used to assess people's actions, attitudes, feelings, and motivation was that measurement error could be high (Jöreskog & Sörbom, 1993). Moreover, these traditional statistical methods did not explicitly examine and assess the consequences of measurement inaccuracy. In other words, conventional statistical analyses made no assumptions about the variance of measurement error for any measured variables (Thompson, 2000). For example, path analysis models regarded single measured variables as precise, error-free representations of the desired construct. According to Bollen (1989) and Maruyama (1998), this method resulted in highly biased effect estimates due to the error's impact.

In contrast to the majority of conventional statistical methods, SEM incorporated score reliability (i.e. [1 - measurement error variance] / total score variance) directly into the model fitting process (Stevens, 1996). Because all measures (tests and surveys) included non-random error, it was critical to incorporate this error into models in a way that did not influence parameter estimates directly (Purpura, 1999). Jöreskog and Sörbom (1989, pp. 151-156) demonstrated how estimation variance may affect parameter estimations and how these effects could be assessed directly using SEM. According to Thompson (2000), the SEM analytical model represented reality since observed variables were not always measured with perfect reliability. Indeed, SEM considered all of the score dependability while estimating parameters, but non-SEM did not.

Several researchers have compiled a list of potential uses for SEM (e.g. MacCallum & Austin, 2000; Marcoulides & Schumacker, 1996; McArdle & Bell, 2000; Thompson, 2000; Zhang, 2018). The list included testing substantive theory (hypothesis testing) to organise concepts about data analysis into scientific models to provide tools for the estimation of the mathematical components of models; to provide means for the evaluation of statistical features of these models; to include flexible provisions for models with unobserved or latent variables; to permit a flexible approach for dealing with incomplete data patterns; to determine direct or indirect (mediation) of one variable to another; and to compare group differences and/or longitudinal differences.

Disadvantages of using SEM

There are several advantages to using SEM. However, some researchers (Jeon, 2015; Joreskog & Sorbom, 1993; MacCallum & Austin, 2000) have shown the disadvantages or limitations of SEM, such as inappropriate interpretation, various modified models, errors from the use of multiple statistical methods, sample size, and interpretation of the result. Jeon (2015) stated that some researchers analyzed the model wrongly or misinterpreted the results. These issues resulted from a lack of understanding of regression, factor, or correlation analyses. Researchers should be familiar with SEM-related approaches. They were applying SEM without comprehending the fundamental concepts, which led to poor and unsuitable interpretation and incorrect use of SEM. The findings were the same when using the same data and applying the same statistical approach in SPSS. However, SEM offered researchers a variety of instruments. When given the same data and research models, different researchers might develop different models (Jeon, 2015; Joreskog & Sorbom, 1993).

Multiple statistical approaches, such as confirmatory component analysis, path analysis, and correlation analysis, were combined and evaluated in one model in SEM. This was both an advantage and a disadvantage of SEM since findings might contain inaccuracies. MacCallum and Austin (2000) noted that a researcher should point out time issues for cross-sectional models with directional impacts. For longitudinal designs, they should also have an autoregressive effect. The best model to support might be determined by sample size. When the sample size was small, simpler models were preferred. A finding of a good fit did not always mean that the model was valid or credible.

A high model fit did not imply that the model's hypothesized effects were strong. The accurate correlation might be very weak, or even zero, because residual variation from endogenous variables could be used to establish the association. A good model fit did not always indicate that such residual variances are tiny. As a result, such data should be discussed and presented to have complete knowledge of the degree of effects (Jeon, 2015).

SEM was an advantageous approach for examining the relationships between test takers' strategy use and test performance (Zhang, 2018). The present study used the SEM analysis to determine the hypothesised model of the relationships between cognitive and metacognitive strategies on EFL reading test performance of Thai high school learners. The SEM analysis incorporated score reliability directly into the model fitting process (Jöreskog & Sörbom, 1989; Stevens, 1996). All measures included non-random error, and the analysis incorporated the error into models in a way that did not directly influence parameter estimates (Purpura, 1999).

3.4 Participants and setting

3.4.1 Participants in the pilot study

A pilot study was conducted before the main study. Before the tests were administered, the content validity of the three tests was evaluated by five experts in English education who have taught English in Thai EFL contexts for more than ten years, including one native speaker, one university professor, and three high school teachers. Additionally, all two tests were piloted with approximately 200 senior high school students to determine their reliability.

The pilot participants included approximately 200 senior public high school students in Northeastern Thailand, who participated with parental consent forms and agreement from all participants and parents to comply with ethical requirements. Both the pilot study participants and the participants in the main study had a comparable level of English ability. In addition, they had been studying English as a required subject for at least ten years before their research. Participants who provided the same ten consecutive answers to different questions were excluded from further analysis because this response pattern was interpreted as lacking fundamental commitment to perform the task. In addition, only the 168 participants who completed all two tests were included in the data analysis in the pilot study. This yielded an 84% response rate. Therefore, the data analysis and results of this pilot study were based on 168 voluntary participants. Moreover, none of these participants were involved in the main study. The tests described in this research were given to participants in the pilot study, and the test scores were examined to determine the reliability of the test.

According to Mackey and Gass (2005), reliability refers to the consistency of a test or a score, and Cronbach's Alpha was used to determine a test's internal consistency and reliability. According to DeVellis (2003), a scale's Cronbach's Alpha coefficient should be more than 0.70, and indications of internal consistency for a well-developed test should approach 0.80 (Dörnyei, 2007).

3.4.2 Participants in the main study

The participants in this study included 735 students from a public high school (or secondary school) in the northeastern part of Thailand who were senior high school (Grade 12), 17-18 years old. Pseudonyms were used to protect the anonymity of the participants. All participants had at least ten years of English studying experience and, therefore, they were assumed to have the same English language learning experience background in school contexts. The current study used convenience sampling methods to select participants as it was an efficient means to obtain basic information quickly and efficiently (Dörnyei, 2007 as cited in Farrokhi & Mahmoudi-Hamidabad, 2012; Sekaran & Bougie, 2016).

The participants were students at a public high school in the northeast of Thailand administered by the Office of the Basic Education Commission (Ministry of Education in Thailand, 2001, 2008, 2017). Their English language skills varied from advanced beginners to upper-intermediate. Additionally, their families came from diverse socioeconomic and occupational backgrounds. According to the Office of the Basic Education Commission (Ministry of Education in Thailand, 2001, 2008, 2017), all participants had completed a minimum of 10 years of EFL courses as a required subject. In addition, they had been required to learn English at school. Each week, the participating high school organised four 50-minute English classes with EFL teachers and one 50-minute English class with native English speakers. This school's class sizes ranged from 20 to 45 students. The Ministry of Education in Thailand classified senior high school students as having an intermediate level of English proficiency. In contrast, the Common European Framework of Reference for Languages (CEFR) in Thailand, developed by the Council of Europe (2001, 2016), classified them as having an advanced level of English proficiency (Ministry of Education in Thailand, 2014).

The students had all gained knowledge of effective reading strategies and were continuing their English studies at a higher academic level.

After permission from the school was obtained, the research was presented to the participants as part of their achievement tests and was conducted for approximately two months. The researcher asked the teachers who did not teach any twelfth-grade subjects. The researcher explained the purpose of the study to the teacher. Then, these teachers explained to participants about the purpose of the research and the nature of the study in the meeting class of twelfth-grade students and provided them with the consent form if the participants were interested in participating in the study. They were instructed to return the signed consent form within a week of receiving the consent form. The participants could give the signed consent form to the researcher when the researcher stopped by their classrooms, or they could leave their consent forms with one of their teachers who was willing to help collect the response. Consent forms were collected from all participants and parents to comply with ethical requirements. Firstly, the participants did the trait questionnaire in the Thai language. Then, the test was administered. The instructions were explained to the participants in their native Thai language. Participants were not allowed to use any tools to help their responses and could not ask questions or observe other participants' responses.

The participants took a reading comprehension test in this study that lasted one hour. A week before taking the reading comprehension test, they used a questionnaire to complete the trait EFL reading comprehension test strategy. After they completed the test, they were asked to answer the state reading comprehension test strategy use questionnaire on their cognitive and metacognitive strategy use. Finally, twelve participants were selected to respond to the retrospective interview questions. Thus, there were three sets of measurement instruments in this study: (1) a reading comprehension test, (2) trait and state reading comprehension test strategy use questionnaires (Phakiti, 2006, 2007), and (3) retrospective interview questions. Any participants who did not complete both the reading comprehension test and questionnaire or were inconvenient to give the information were removed from the main study. The participants had the right to withdraw from the study at any point if they were inconvenient. The research project had been completed. Finally, a number

of screening measures were implemented. Participants who left answers blank to all questions were excluded from the analysis.

Those who provided the same ten consecutive answers in response to different questions and did not answer all trait and state strategy use questionnaires were excluded. The participants included in the present study were 685 students. This represents a 93.20 % response rate.

3.4.3 Interviewees

Twelve test-takers were interviewed retrospectively in Thai (Gass & Mackey, 2000; Phakiti, 2014). The following criteria were used to choose interviewees: (1) an equal number of very successful and unsuccessful participants based on the final exam result; (2) an equal number of males and females in each group; and (3) a willingness to participate in the interview session, which included a 10-minute reading test. To keep their identities private and anonymous, they adopted pseudonyms. The interviews were transcribed and translated into English, with the transcripts being double-checked.

3.4.4 EFL classroom context

According to the Office of the Basic Education Commission (Ministry of Education in Thailand, 2001, 2008, 2017), the learning area of foreign languages was aimed at enabling learners to acquire a favourable attitude towards foreign languages, the ability to use foreign languages for communicating in various situations, seeking knowledge, engaging in a livelihood, and pursuing further education at higher levels. Learners thus had knowledge and understanding of diversified matters and events of the world community. They were able to creatively convey the conceptions and cultures of Thainess to the global society. The main contents of language subjects included Language for Communication, Language and Culture, Language and Relationship with Other Learning Areas, and Language and Relationship with Community and the World.

As mentioned, all participants completed a minimum of ten years of EFL courses as a required subject, and they attended four 50-minute English classes per week with EFL

teachers and one 50-minute English lesson with native English speakers. This school's class sizes ranged from 20 to 45 students.

3.4.5 Ethical consideration

The current research required permission from Mahasarakham University's Ethics Committee. After the Ethics committee sent the researcher an ethics approval certificate, the researcher asked the school for permission to collect data. The permission to collect data was approved, and all participants were recruited using a set of formal processes. The consent form informed the participants of the purpose of the study. It provided the participants the following information regarding their participation: (a) they might withdraw from the study at any time by orally telling the teacher or the researcher, (b) all the information obtained from the study was kept confidential, (c) there were no known risks associated with their participation in the study, and (d) they did not receive compensation for participating in the study, but they would receive the benefits of reflecting on their cognitive and metacognitive strategy use on reading test performance. There were minimal risks for participants. The risk might include discomfort for the participant because they did the tests within the time limit. The participants could tell their risks to their teacher or the researcher. The Participation Information Sheet and Consent Form for Principals was first required from the school principals for ethical approval. Second, all potential participants were given a Participant Information Sheet about the research and a form of participation consent before the study began. Third, students who submitted written informed consent forms with their signatures and their parents' signatures were the subjects of the study.

Data were collected by using paper-and-pen answering sheets and questionnaires, and they were kept confidential. Any data that made it possible to identify individual participant information was not included in the reading tests and questionnaires, and the tests and questionnaires were filled out anonymously. To link the reading test scores of participants as well as the retrospective interview data, a master list of participants was created. Each name on the list was assigned a number. The questionnaire responses were coded with numbers to ensure that the participants could fill out the questionnaires anonymously, and at the same time, the questionnaires

could be linked with the EFL reading test scores and the interview data. The hard copies of the reading comprehension tests and questionnaires were kept in a locked file cabinet, and the data related to the study were stored in a password-protected computer to ensure the security of the data. The master list of participants was kept separately from the rest of the research data as a security precaution. Only the researcher had access to response data and any lists generated from data collection procedures, including the master list. The master list was destroyed after students' reading comprehension test scores and questionnaires were linked. Identifiable data would be destroyed three years after completion of the research project.

In other words, all participants were recruited using a set of established processes. To begin, ethical permission was sought from school administrators, which included the Participation Information Sheet and Principal Consent Form. Then, before the study started, all participants received a Participant Information Sheet and a permission form for participation. Finally, all participants submitted written informed consent forms signed by themselves and their parents.

3.5 Research instruments

Based on previous research, the current study used three research instruments: (1) reading comprehension tests, (2) trait and state reading comprehension test strategy use questionnaires in Thai, and (3) an interview in Thai.

3.5.1 An EFL reading comprehension test

The test was developed following the strand and indicators of the national curriculum of the Office of the Basic Education Commission (OBEC) and piloted for content and reliability analyses by the researcher and five experts in English education. There were 60 questions, including both Rational Cloze and Text Comprehension type questions. The choice of the test format was based on comprehensive research in language testing (LT) (Bachman, 2000; Dudley, 2006; Hossain & Ahmed, 2015; Kobayashi, 2002; Yang and Qian, 2017). The test was created according to internal test requirements and piloted by the researcher and language teachers at a Thai high school for content and reliability assessments. Chapter 2 described the gap-filling and multiple-choice test formats used in the current study (Hossain & Ahmed, 2015), some of the most often used traditional test forms for evaluating reading

comprehension. This was likely because they were easy to administer, and item analysis methods were well-established.

The texts used in the tests were composed of (1) grammatical features (e.g., the relationship between the structure of sentences and the vocabulary used, such as sentence types and verb forms); (2) pragmatic features (e.g., the principal intent of the writer such as exposition and argument); and (3) discourse features (e.g., the relationship between the nature and the structure of the text as a whole, such as rhetorical properties (e.g., definition, description, classification, illustration, cause/effect, problem/solution and comparison/contrast) and textual organisations (e.g., narrative and expository).

The topics in the tests included family, occupation, clothing and fashion, personalities, accommodation, food and drink, environment, travel and transportation. Appendix A provided samples of the first and second reading tests. Both tests were composed of two major sections, each with sub-sections, as described below.

Section 1: Gap-filling (like rational cloze)

This section (composed of 3 sub-sections) was designed to measure the test-taker's ability to comprehend texts drawing on their knowledge of structural and lexical appropriacy and their pragmatic and discourse competence (see Read, 2000). Items tested were selected based on the structural, lexical, pragmatic and discourse skills taught in the class. There were 20 test items (10 to measure reading/vocabulary and 10 to measure reading/grammar). The performance of this study in this section was labelled as lexico-grammatical reading ability (LexGrRA).

Section 2: Reading comprehension test

This section (composed of 2 sub-sections) consisted of various passages ranging from 100 words to 700 words. It aimed to measure the test-taker's ability to read English texts for main ideas, details, and inferences. The first sub-section aimed to measure scanning and skimming for information abilities. The second sub-section measured the ability to identify main topics/ideas, titles, writer's purposes, reference words, implied statements, vocabulary in context, and specific details. In each test, there were

45 items for Section 2. For this study, performance was labelled as text comprehension (TxtCOMP). Table 1 summarizes the types of questions in the reading comprehension section.

Table 1 Summary of the types of questions in the reading comprehension section

Question	Explanation	Example
The main idea, main topic and main purpose questions	These questions ask learners to identify an answer choice that correctly summarizes the whole passage's main idea and subject or the author's purpose of writing the passage.	- "The passage is mainly about _____." - "What is the purpose of the writer?"
Functional questions	These questions ask learners to locate and identify answers to questions about specific information and details in the passage.	- "The passage shows us that American _____ privacy" - "According to the comic, the family plans to _____ on weekends." - "According to the passage, which statement is true?"
Negative questions	These questions ask learners which learner choices are NOT discussed in the passage.	- "What is NOT true about dental hygienists?" - "The animal's daily needs (line 2) is as followings EXCEPT _____."
Inference questions	These questions ask learners to draw conclusions based on information in the passage.	- "What can be inferred from this passage?" - "Which of the following can be inferred from the passage?
Vocabulary-in-context questions	These questions ask learners to identify the meaning of a word or phrase as used in the passage.	- "The closest meaning of the word "sternly" is_____."
Reference questions	These questions ask learners to identify the noun to which a pronoun or other expression refers.	- "**It**" in the sentence "**It**'s something to be both respected and defended..." refers to _____."

Scoring criteria

Each test item was regarded as equally significant in assessing reading comprehension ability. Multiple-choice tests have traditionally been graded using the number right (NR) scoring method (Bereby-Meyer et al., 2002; Kurz, 1999). Correct answers received a positive score, whereas wrong responses and absent or missing answers received a zero. The test score was the total of the correct response scores. A limitation of this scoring method was that learners could guess the correct response (Choppin, 1988; Budescu & Bar-Hillel, 1993; Frary, 1988; Kubinger et al., 2011). Guessing introduced an unpredictable component into test scores, reducing reliability and validity (Bereby-Meyer et al., 2002; Burton, 2001; Kubinger et al., 2011; Prihoda et al., 2006). Test designers could not differentiate between correct responses based

on knowledge mastery and those based on a guess (Bar-Hillel, Budescu & Attali, 2005). All test papers were marked and double-checked to guarantee proper scoring of all items.

3.5.2 Cognitive and metacognitive strategy use questionnaire

The questionnaire items in this study were slightly adapted from Phakiti's (2007) study. Strategy use items on the questionnaire were selected from the literature on learning strategies (e.g., O'Malley & Chamot, 1990; Oxford, 1990; Purpura, 1999), reading strategies (e.g., Carrell, 1989b; Mokhtari & Reichard, 2002; Phakiti, 2003, 2008; Pressley & Afflerbach, 1995; Purpura, 1999; Sheorey & Mokhtari, 2001), and test-taking studies (e.g., Anderson, 1991; Anderson, Bachman, Perkins, & Cohen, 1991; Cohen & Upton, 2006). The items were chosen based on the theory of human information processing (Gagne, Yekovich & Yekovich, 1993), which postulated (1) a structural component of sensory receptors, working and long-term memory arrays and (2) a functional component of information processing that described the operations of comprehending, memory, retrieval and control processes at different specific stages. Appendix B provided the English version of the state and trait strategy use questionnaires. The trait strategy use questionnaire was written using the Simple Present as it asked students about their general strategy use. In contrast, the state strategy used the Simple Past to ask students about their thinking during the test. For example, an item of a state planning strategy in a test situation was *'I had made a plan before I began the reading comprehension test.,'* A generally perceived trait planning strategy was *'I make a plan before I begin the reading comprehension test.'*

The questionnaire was given in Thai to prevent language problems in measuring their cognitive and metacognitive strategy use. The questionnaire used in this study allowed learners to mark strategy use on a 6-point Likert scale: 0 (Never), 1 (Rarely), 2 (Sometimes), 3 (Often), 4 (Usually), and 5 (Always), according to Phakiti (2007). The length of time required to complete the survey is approximately 10-15 minutes. Many strategies (e.g., O'Malley & Chamot, 1990; Oxford, 1996; Purpura, 1999; Zhang, 2018) and SEM researchers (e.g., Bentler, 1995; 2006; Byrne, 1994, 2010; Kline, 1998; Osuji, 2017; Zhang, 2018) supported the usefulness of Likert-scale questionnaires. Table 2 presents the strategy composites in the questionnaires.

Table 2 Internal consistency of state cognitive and metacognitive strategies

Processing	Subscale	No. of items	Items
Cognitive strategies	Comprehending	6	11, 12, 13, 14, 15, 16
	Memory	8	17, 18, 19, 20, 21, 22, 23, 24
	Retrieval	7	25, 26, 27, 28, 29, 30, 31
Metacognitive strategies	Planning	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
	Monitoring	14	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45
	Evaluating	6	46, 47, 48, 49, 50, 51
Total		**51**	

3.5.3 Retrospective interview

The retrospective interviews (Gass & Mackey, 2000; Phakiti, 2014) were conducted with twelve test-takers in Thai. The criteria used to select the interviewees were as follows: (1) based on the final exam score, an equal number of highly successful and unsuccessful participants were selected; (2) each group had an equal number of males and females; and (3) a willingness to engage in the interview session, which included a 10-minute reading test. The interviews were transcribed and translated into English, and the transcripts were double-checked for accuracy. The analysis of this data revealed the ideas (content) or trends of how the test takers use metacognitive and cognitive strategies in the reading test. Specifically, retrospective post-test interviews provided qualitative information regarding the participants' experiences completing the test. The following five interview questions were asked:

1. Can you tell me what you did when you read this passage (i.e. before/while/after)? Tell me about the strategies you used to help you understand.
2. What strategies did you use to help in answering the questions?
3. How did you use the reading passage to support your response/answer?
4. Did you randomly guess on any EFL reading questions? If so, what type of questions (i.e., factual, vocabulary, inferential) did you guess randomly? Why?
5. Which question format do you think improved your reading comprehension more? Why do you think they helped you understand the reading passages?

Validity and reliability

To ascertain the validity of the instruments, the experts were asked to evaluate the reading comprehension tests, questionnaires, and retrospective interview questions. All construct validity, face validity, and content validity were checked. The internal consistency reliability of reading comprehension tests and questionnaires were analysed. A Cronbach's (1951) alpha coefficient was obtained using SPSS for the responses to the instruments. Nunnally's (1978) widely accepted social science cutoff Cronbach's $\alpha > 0.70$ was used to assess the reliability of the scales. Nunnally and Bernstein (1994) recommended that items with a correlation of $r \leq .30$ to their scale should be retained. Cronbach's Alpha if Deleted values were then analyzed to determine other potential problems by examining if any of the values exceeded the alpha reliability estimate for its factor. If Cronbach's Alpha Deleted exceeded its factor, it signalled that the reliability would increase if the item were removed. Any items flagged by Cronbach's Alpha if deleted were examined, and the item was removed if it made substantive sense.

3.6 Data collection procedure

The test was organised around various reading tasks with two major parts. There were 60 questions, including both Rational Cloze and Text Comprehension questions. The purposes of the two test parts differed regarding the underlying theoretical reading constructs being measured and the nature of the tasks presented. Students completed the test twice.

Methods typically used to understand the nature of strategies included verbal reports (e.g., think-aloud protocols, retrospective interviews) and self-report questionnaires. In the present study, a Likert-scale questionnaire was used. In the context of a large-scale study, it could also be difficult or impossible to tape-record all participants while taking the reading test. Furthermore, the think-aloud methodology was highly complex, and the participants needed much practice before actual data gathering to achieve optimal think-aloud validity. By contrast, many researchers supported the usefulness of Likert-scale questionnaires (e.g., O'Malley & Chamot, 1990; Oxford, 1996; Purpura, 1999; Osuji, 2017; Zhang, 2018; Bentler, 1995; 2006; Byrne, 1994; Kline, 1998; Zhang, 2018). The strategy questionnaire in this study was adopted from

the questionnaire used by Phakiti (2007). The questionnaire was piloted for item-level analysis, such as reliability estimates, before its actual use in this study, and it was given in Thai.

Figure 4 represents a flow chart of the data collection procedure. The participants answered the strategy use questionnaire approximately one week before each test was given. The length of time to complete the questionnaire was about 15 to 25 minutes. State strategies were immediately measured after test-takers completed the test. The second test occurred approximately two months after the first test.

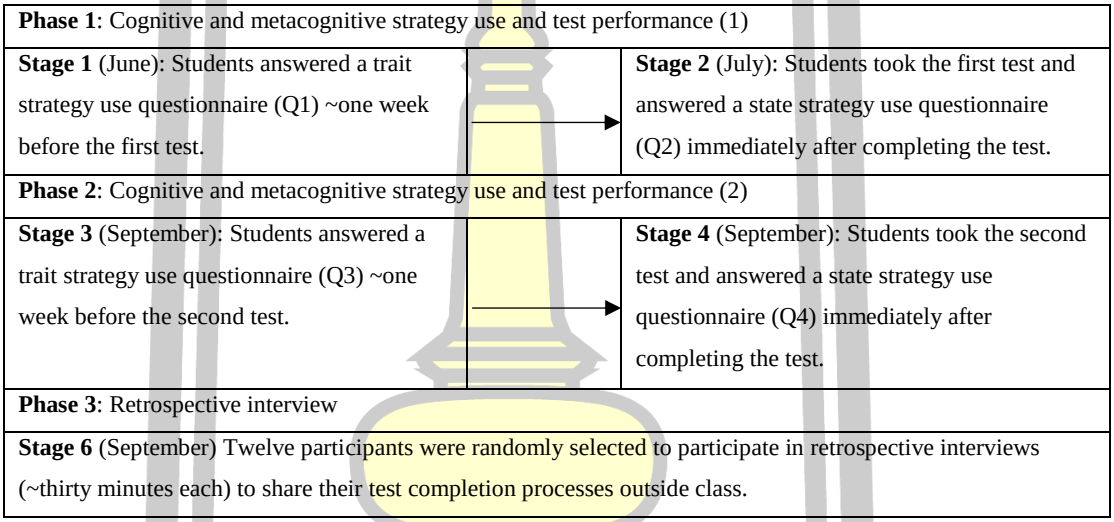


Figure 4 A flow chart of the data collection procedure

3.7 Data analysis

The current study applied quantitative and qualitative data collection approaches. The Statistical Packages for Social Sciences (SPSS) program version 16 computed descriptive statistics and performed reliability analyses. It also completed the full-latent SEM (Bentler, 1985-2006) to reveal the relationships between cognitive and metacognitive strategies and EFL reading variables.

The retrospective interview data was reduced using a coding system derived from the strategy typologies based on the substantive theories of reading comprehension, metacognition, and emerging codes from data (Phakiti, 2000). The codes here were used to discover themes or issues that may appear from the data set. Typical metacognitive and cognitive strategy use patterns were identified after the transcripts

were coded and rechecked for coding consistency. Only two data display matrices (e.g., those in Lynch, 1996; Miles and Huberman, 1994) were presented.

3.7.1 Quantitative data analysis

Reading comprehension test analyses

The data from the cognitive and metacognitive reading comprehension tests were analysed using the Rasch IRT through the use of the Quest Program (Adams & Khoo, 1996) for evidence of internal consistency, item difficulty, personability, and item discrimination analysis. Concerning the present study, particular attention was given to (1) evidence that the test data were used to postulate an SEM model of EFL reading test performance and (2) assessment of misfitting test-takers. Any severely misfitting test-takers were excluded from SEM analyses in this study.

Rasch IRT was an influential measurement theory that estimated both the ability levels of test-takers and the characteristics of test items. The Rasch IRT model proposed a simple mathematical relationship between ability and difficulty and then expressed this relationship at the probability of a particular response (McNamara, 1996). The IRT procedure in the present study could be summarised in three sections. Firstly, after being implemented, the tests were scored and double-checked. Then, the test data were entered into a computer and analysed using the Quest Program. In the data preparation, students' answers to each question of the reading comprehension test (i.e. 1, 2, 3, or 4) were keyed into a word processor (and later converted into a text file). If students did not answer the question, a code '9' was used. Finally, after the IRT command program was written up, checked and tested, the test data was analysed.

Questionnaire analyses

A number of item-level analyses were conducted before actual SEM analyses (as reported in the next chapter). These analyses aimed to validate the constructs of cognitive and metacognitive strategies (see Table 2.) The first analysis was related to the psychometric property of the questionnaire instrument. The internal consistency of a questionnaire was grounded in the idea that responses to items were independent of each other. For example, consider these two monitoring strategy items, '*I knew when I*

should pay more attention to the reading comprehension test.' and" '*I managed the time effectively on the reading comprehension test*.' The same test-takers likely similarly endorsed the two items, exhibiting the use of monitoring strategies. Hence, observed responses to the two items were consistent within an individual. The present study has recognised the need to use multiple observed variables to define latent variables. As discussed in Chapter II, multiple measures of each latent variable were preferred based on the substantive methodology in the SEM approach. Using multiple observed variables, the researcher permitted measurement error to be estimated through SEM. For SEM analyses to be rigorous, data distributions and internal consistency estimates needed to be considered carefully. This information could confirm that certain assumptions, such as univariate normality, are not violated in the dataset.

SEM analysis

The Statistical Packages for Social Sciences (SPSS) version 29 application generated descriptive statistics and conducted reliability studies. Many statistical procedures were used in the present study. First, IRT test analyses examined internal consistency, item difficulty, personability, and misfitting statistics. Next, data preparation was used in scoring, inputting, checking for missing values, eliminating misfitting test-takers, and inputting data. Then, descriptive statistics examined central tendencies and checked for normality, and reliability analysis examined the homogeneity of scales. Confirmatory factor analysis examined item clusters, forming composite variables, and outlier analysis. Single-group SEM was used to assess the measurement models, examine the structural models, estimate parameters, model identification, and estimation. Model respecifications were for comparisons of models. Finally, they were presenting and interpreting models.

3.7.2 Qualitative data analysis

After completing the reading test, participants completed a questionnaire describing their strategy use. Moreover, eight participants were randomly selected to participate in retrospective interviews (about thirty minutes each) to share their test completion processes outside class. At the beginning of the interview, participants were given reading comprehension tests and questionnaires to stimulate their memories. Then,

participants were asked to describe their test-completion processes and shared perceptions about the test format. Participants could refer to the stimuli (EFL reading comprehension tests) anytime to help them engage in the interview more effectively. The interview protocol was developed based on the literature (e.g., Anderson et al., 1991; Kintsch & Yarbrough, 1982; Nevo, 1989; Pressley et al., 1990) regarding cognitive and metacognitive strategy used effects on EFL reading comprehension tests. See Appendix C for the full interview protocol. Sample interview questions included:

1. Could you tell me what you did when you read this passage (i.e. before/while/after)? Tell me about the strategies you used to help you understand;
2. What strategies did you use to help answer the questions?
3. How did you use the reading passage to support your response/answer? Participants who engage in the interviews will receive 200 baths as compensation.

Interviews were audio-recorded and transcribed. The transcription code of the interviews was based on Poland's (1995) verbatim audio transcription. The analysis of the interview data was centred on assessing participants' cognitive and metacognitive strategies used in the context of EFL reading comprehension tests. The data was analysed using qualitative methods and presented within a thematic framework.

3.8 Summary

The current study employed a mixed-methods approach, which was then described in this chapter. The quantitative and qualitative data collecting and analysis processes and the ethical considerations associated with the research were also elaborated upon. In addition, the quantitative methodology, including the SEM analysis, was elaborated upon, as were the qualitative data, including an account of the interview procedure and its analysis. The research design employed in this study is depicted in Figure 5.

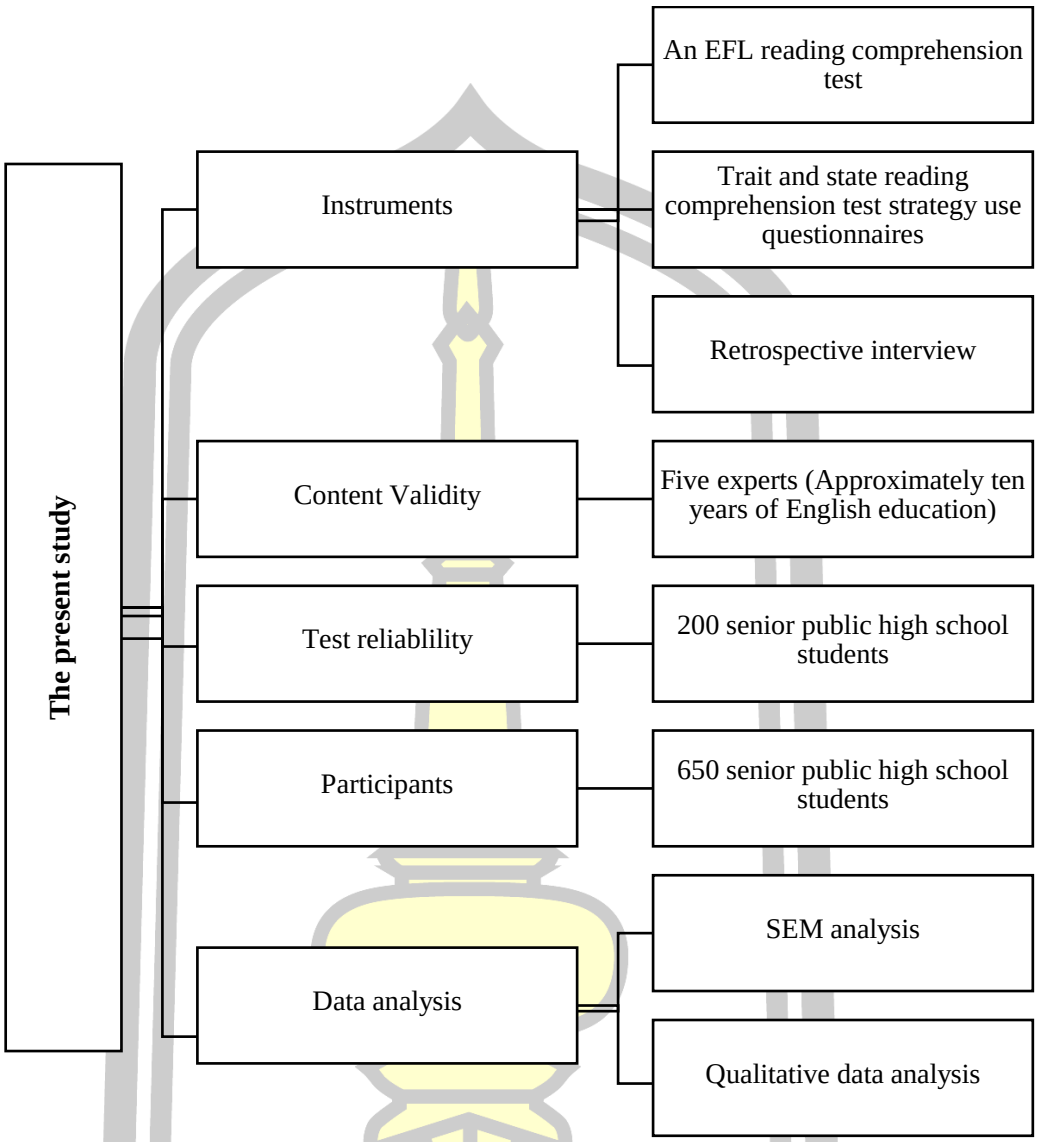


Figure 5 The research design for the present study

CHAPTER IV
RESULTS OF THE PILOT STUDY

In this chapter, the results of the pilot study are detailed. The chapter furnishes the essential details required to compute the sample size and evaluate all other pertinent facets of the primary investigation. Additionally, this chapter analyses the results that reduce extra effort on the part of the researcher and participants, in addition to the wastage of research resources. This chapter provides a detailed account of the pilot study's methodology and content validity. This chapter provides an overview of the study protocol's feasibility, which mirrors the entire sequence of procedures employed in the main study. It validates the study's feasibility by examining participants' inclusion and exclusion criteria, testing the research instruments utilized for measurements, and training researchers and research assistants. Furthermore, the chapter evaluates the approach's appropriateness for gathering data. A chapter summary concludes this particular chapter.

4.1 The procedure of the pilot study

As a "try-out" on a smaller scale, the pilot study was conducted before the main investigation. Piloting had the benefit of revealing potential flaws in the main study and determining whether the research tools were suitable. Conversely, a pilot study aimed to pre-test a specific research instrument, including questionnaires and tests (Baker, 1994). Before the official data collection, a pilot study was conducted in April 2022 to ensure the equipment's validity. In the pilot project, a total of 200 twelfth-grade students from the sample school participated in EFL reading comprehension assessments. Additionally, questionnaires assessing trait and state EFL reading comprehension method use and retrospective interview questions were utilized.

To assess the reliability of the newly developed instruments, a pilot research was conducted to develop test items for robust EFL reading comprehension assessments (Test A and Test B). The pilot study assessed the reliability and validity of the EFL reading comprehension test measure. Five English education professionals with more than 10 years of experience teaching English in Thai EFL contexts evaluated the content validity of these two examinations. Among them were two university instructors and three high school instructors. A pilot study was conducted with 200

Thai high school students in the twelfth grade to assess the reliability of both examinations. In addition, an analysis was conducted to identify the most effective items for the final version of the test by evaluating their difficulty and discriminating. However, a subset of pupils failed to complete both assessments, leaving over fifty percent of the examinations blank. A total of 168 students successfully completed the pilot study for exams A and B, representing an 84% completion rate. The following were incorporated into the pilot analysis.

4.2 Content validity

4.2.1 Examining content validity of EFL reading comprehension tests

The concept of content validity pertains to the manner in which assessment items purport to be evaluated (Bachman & Palmer, 2010; Lynn, 1986). A total of five raters were chosen, all of whom had instructional experience in Thailand for English as a foreign language (EFL) for around ten years and were listed in the school curriculum. Concerning EFL reading comprehension examinations, the raters were directed to assess the content validity of items using a Likert scale that extended from -1 to +1. (Hambleton, Swaminathan, Algina, & Coulson, 1978). When responses do not measure the items, raters were told to provide a value of -1; when uncertain or unclear, assign a value of 0; and when things were measured, assign a value of +1. A scale coefficient greater than 0.5 is considered a beneficial quality for every test item. The content validity of various tests suggested a validation method for content validity in relation to Lynn (1986).

Table 3 Test content validity (five experts)

Tests	Mean	Test items	Total of items
A	1.00	21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 55, 56, 57, 58, 59, 60	37
	0.80	1, 2, 3, 4, 5, 7, 11, 12, 13, 15, 16, 17, 18, 19, 20, 39, 43, 54	18
	0.60	6, 8, 9, 10, 14	5
B	1.00	21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 55, 56, 57, 58, 59, 60	39
	0.80	1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 54	18
	0.60	8, 9, 10	3

The 37 items from test A and the 39 items from test B, the mean of which is 1.00, are displayed in Table 3. Test A contained 18 things, and test B also contained 18 items, for a total of 0.80. A small number of the objects had a mean of 0.60.

4.2.2 Examining content validity of trait and state reading comprehension test strategy use questionnaires

Table 4 presents the content validity of trait and state reading comprehension test strategy use questionnaires.

Table 4 Test content validity (five experts)

Questionnaires	Mean	Test items	Total of items
Trait	1.00	1, 2, 3, 4, 6, 7, 8, 10, 11, 13, 14, 15, 17, 18, 20, 23, 24, 25, 26, 29, 33, 39, 40, 41, 43, 47, 48, 49, 50, 51	30
	0.80	5, 12, 19, 22, 27, 28, 30, 31, 34, 35, 37, 45, 46	13
	0.60	9, 16, 21, 32, 36, 38, 42, 44	8
State	1.00	1, 2, 3, 4, 6, 7, 8, 11, 13, 14, 15, 17, 19, 22, 23, 24, 25, 26, 29, 31, 32, 33, 35, 37, 39, 41, 43, 47, 48, 49, 50, 51	32
	0.80	5, 10, 12, 18, 20, 27, 28, 30, 34, 36, 38, 42, 44, 45, 46	15
	0.60	9, 16, 21, 40	4

Table 4 illustrates the 30 items in the trait questionnaire and 32 items in the state questionnaire, with a mean of 1.00. There were 13 items in the trait questionnaire and

15 items in the state questionnaire, with a mean of 0.80. There were eight items in the trait questionnaire and 4 items in the state questionnaire, with a mean of 0.60.

4.3 Reliability

4.3.1 Examining the reliability of EFL reading comprehension tests

Internal consistency and reliability were measured by Cronbach's Alpha, which is related to the consistency of a test or score (Mackey & Gass, 2005). The elements in EFL reading comprehension tests were subjected to Cronbach's alpha, demonstrating substantial internal consistency. According to DeVellis (2003), Cronbach's Alpha coefficient of a scale ought to exceed 0.70, whereas internal consistency indicators for a test that had been adequately constructed should approach 0.80 (Dornyei, 2007). The acceptance of the internal consistency reliability estimated for the formats of various items on the EFL reading comprehension exam was demonstrated by the pilot results.

After collecting the students' answer sheets, the researcher marked all the papers, adjusted the distribution of score values, and revised the marking scheme based on the students' answers. The reliability of the questions in two sections of EFL reading comprehension tests A and B in terms of Cronbach's Alpha were 0.94 and 0.93, respectively.

Item analysis

The process of determining the most effective items for the instruments by evaluating the difficulty and discrimination of each item in each test was utilized to justify the selection and rejection of particular items based on their discrimination power and difficulty value (Hopkins & Antes, 1990). In order to identify and differentiate the appropriate items for participants, this analysis was implemented. The item property's neutrality ranges from 0.20 to 0.80 in direct proportion to the difficulty of the item, signifying objects of moderate difficulty. Item difficulty was indicated by values exceeding 0.80; conversely, things with difficulty were denoted by values falling below 0.20. The item property exhibited an appropriateness ranging from 0.20 to 0.80 with respect to item discrimination. Indicating the need for adjustment, this indicated that the item values were either below 0.20 or above 0.80. With the appropriate items

for assessing EFL reading comprehension in the research environment, each test was meticulously prepared in accordance with the pilot results.

Table 5 presents the results of item-total statistics of an EFL reading comprehension test A. Table 6 shows the results of item-total statistics of an EFL reading comprehension test B.

Table 5 Results of item-total statistics of an EFL reading comprehension test-A

Items	Difficulty	S.D.	Discrimination	N	Items	Difficulty	S.D.	Discrimination	N
1	**0.58**	0.495	0.269	168	31	**0.57**	0.496	0.523	168
2	0.39	0.490	0.277	168	32	**0.58**	0.494	0.617	168
3	0.43	0.497	0.361	168	33	0.45	0.499	0.440	168
4	**0.58**	0.495	0.459	168	34	0.52	0.501	0.639	168
5	0.38	0.486	0.517	168	35	0.48	0.501	0.622	168
6	0.42	0.495	0.302	168	36	**0.58**	0.494	0.561	168
7	**0.54**	0.500	0.500	168	37	0.45	0.499	0.478	168
8	0.43	0.497	0.316	168	38	0.70	0.461	0.528	168
9	0.37	0.484	0.474	168	39	0.54	0.500	0.609	168
10	0.51	0.501	0.320	168	40	0.44	0.498	0.457	168
11	0.50	0.501	0.412	168	41	***0.42***	0.494	0.633	168
12	0.38	0.486	0.323	168	42	0.48	0.501	0.650	168
13	0.46	0.500	0.322	168	43	0.46	0.500	0.604	168
14	0.48	0.501	0.515	168	44	**0.57**	0.497	0.524	168
15	0.49	0.501	0.554	168	45	0.38	0.486	0.573	168
16	0.45	0.499	0.393	168	46	0.38	0.486	0.552	168
17	0.35	0.479	0.405	168	47	0.60	0.491	0.606	168
18	***0.40***	0.491	0.406	168	48	0.43	0.496	0.278	168
19	***0.42***	0.495	0.488	168	49	0.50	0.501	0.612	168
20	**0.57**	0.497	0.466	168	50	0.51	0.501	0.613	168
21	0.39	0.490	0.563	168	51	0.54	0.500	0.572	168
22	0.51	0.501	0.536	168	52	**0.58**	0.494	0.588	168
23	0.49	0.501	0.625	168	53	0.38	0.487	0.486	168
24	0.71	0.456	0.498	168	54	0.50	0.501	0.614	168
25	0.45	0.499	0.593	168	55	0.52	0.501	0.564	168
26	0.47	0.501	0.614	168	56	0.42	0.494	0.575	168
27	0.61	0.490	0.615	168	57	0.49	0.501	0.517	168
28	**0.57**	0.496	0.487	168	58	0.39	0.490	0.514	168
29	0.60	0.492	0.520	168	59	0.46	0.500	0.659	168
30	0.39	0.490	0.573	168	60	***0.42***	0.494	0.607	168

Table 5 shows that the item difficulty of all items is in the range between 0.20 and 0.80. For item discrimination, acceptable values were 0.20 or higher; the closer to 1.00, the better. There were 11 difficulty items (=18.33%) which difficulty value lower than 0.40, items 2, 5, 9, 12, 17, 21, 30, 45, 46, 53 and 58. There were five easy

items (=8.33%) with difficulty values higher than 0.60, items 24, 27, 29, 38 and 47. The discrimination of all items was acceptable.

Table 6 Results of item-total statistics of an EFL reading comprehension test B

Items	Difficulty	S.D.	Discrimination	N	Items	Difficulty	S.D.	Discrimination	N
1	0.65	0.479	0.437	168	31	0.40	0.492	0.372	168
2	0.33	0.471	0.302	168	32	0.79	0.412	0.539	168
3	0.46	0.500	0.286	168	33	0.79	0.412	0.468	168
4	**0.61**	0.490	0.345	168	34	0.36	0.481	0.322	168
5	0.59	0.493	0.249	168	35	0.77	0.420	0.454	168
6	0.50	0.501	0.401	168	36	0.28	0.450	0.584	168
7	0.79	0.412	0.339	168	37	0.58	0.495	0.577	168
8	0.54	0.500	0.363	168	38	0.35	0.477	0.515	168
9	***0.38***	0.486	0.353	168	39	0.78	0.416	0.582	168
10	0.40	0.492	0.282	168	40	0.71	0.453	0.471	168
11	0.40	0.491	0.351	168	41	**0.64**	0.482	0.289	168
12	0.45	0.499	0.497	168	42	**0.64**	0.481	0.277	168
13	0.35	0.479	0.274	168	43	0.78	0.416	0.649	168
14	0.46	0.500	0.234	168	44	0.24	0.427	0.516	168
15	0.46	0.500	0.314	168	45	0.36	0.481	0.372	168
16	0.30	0.459	0.530	168	46	0.69	0.464	0.501	168
17	0.45	0.499	0.285	168	47	0.77	0.423	0.362	168
18	0.49	0.501	0.347	168	48	0.65	0.479	0.562	168
19	0.33	0.471	0.495	168	49	0.40	0.491	0.303	168
20	0.56	0.498	0.267	168	50	**0.61**	0.490	0.602	168
21	0.71	0.453	0.424	168	51	0.69	0.464	0.445	168
22	***0.39***	0.488	0.379	168	52	0.28	0.450	0.709	168
23	0.73	0.447	0.487	168	53	0.38	0.487	0.324	168
24	0.79	0.412	0.486	168	54	0.68	0.468	0.615	168
25	0.59	0.493	0.414	168	55	0.45	0.499	0.586	168
26	**0.61**	0.490	0.432	168	56	0.49	0.501	0.368	168
27	0.27	0.447	0.398	168	57	0.25	0.434	0.434	168
28	0.64	0.481	0.418	168	58	0.45	0.499	0.389	168
29	0.73	0.444	0.451	168	59	**0.61**	0.488	0.632	168
30	0.71	0.453	0.507	168	60	0.29	0.456	0.525	168

Table 6 shows that there are 16 difficulty items (=26.66%) which the difficulty value which lower than 0.40, items 2, 9, 13, 16, 19, 22, 27, 34, 36, 38, 44, 45, 52, 53, 57 and 60. There are 25 easy items (=21.66%) The difficulty value which higher than 0.60, items 1, 4, 7, 21, 23, 24, 26, 28, 29, 30, 32, 33, 35, 39, 40, 41, 42, 43, 46, 47, 48, 50, 51, 54 and 59. The discrimination of all items is acceptable.

Table 5 and Table 6 show that the difficulty of test items is not equal. The two tests should be parallel. Each test should have 25% difficult items, 50% moderate items, and 25% easy items. Both tests have been revised as shown in Table 7, the test item difficulty of tests A and B.

Table 7 The test item difficulty of tests A and B

Test	Difficulty level	Items	% of items before revised	Select items to revised	% of items after revised
A	Difficult (0.20-0.39)	2, 5, 9, 12, 17, 21, 30, 45, 46, 53, 58	18.33	18, 19, 41, 60	25.00
	Moderate (0.40-0.59)	**1**, 3, **4**, 6, **7**, 8, 10, 11, 13, 14, 15, 16, ***18, 19***, **20**, 22, 23, 25, 26, **28**, **31**, **32**, 33, 34, 35, **36**, 37, 39, 40, ***41***, 42, 43, **44**, 48, 49, 50, 51, **52**, 54, 55, 56, 57, 59, ***60***	73.33		50.00
	Easy (0.60-0.80)	24, 27, 29,38, 47	8.33	1, 4, 7, 20, 28, 31, 32, 36, 44, 52	25.00
B	Difficult (0.20-0.39)	2, ***9***, 13, 16, 19, 22, 27, 34, 36, 38, 44, 45, 52, 53, 57, 60	26.66		25.00
	Moderate (0.40-0.59)	3, 5, 6, 8, 10, 11, 12, 14, 15, 17, 18, 20, 25, 31, 37, 49, 55, 56, 58	31.66	4, 9, 22, 26, 41, 42, 50, 59	50.00
	Easy (0.60-0.80)	1, **4**, 7, 21, 23, 24, **26**, 28, 29, 30, 32, 33, 35, 39, 40, **41**, **42**, 43, 46, 47, 48, **50**, 51, 54, **59**	41.66		25.00

Table 8 presents descriptive statistics of observed EFL reading comprehension test variables on test A. Table 9 shows descriptive statistics of observed EFL reading comprehension test variables on test B.

Table 8 Descriptive statistics of three observed EFL reading comprehension test variables on test A (N = 168)

Item	No. of items	Min	Max	Mean	S.D.	Skewness	Kurtosis
LexGrRA1	10	0	10	4.63	2.49	0.671	-0.298
LexGrRA2	10	0	10	4.49	2.70	0.541	-0.511
TxtCOMP1	40	2	40	19.91	11.66	0.655	-0.958
Test A	60	8	60	29.04	14.67	0.694	-0.707

Table 9 Descriptive statistics of three observed EFL reading comprehension test variables on test A (N = 168)

Item	No. of items	Min	Max	Mean	S.D.	Skewness	Kurtosis
LexGrRA3	10	0	10	5.24	2.54	0.039	-0.976
LexGrRA4	10	0	10	4.25	2.71	0.823	-0.450
TxtCOMP2	40	2	40	22.31	9.69	-0.353	-.0933
Test B	60	5	60	31.80	12.83	0.157	-0.537

According to Hotiu (2006) the *p* (proportion) value ranged from 0 to 1. When multiplied by 100, the p-value converted into a percentage, which was the percentage of students who got the item correct. The higher the p-value, the easier the items. This indicated the higher the difficulty index, the easier the item was understood. Those with a p-value between 20% and 90% were considered as good and acceptable. Among these, items with a p-value of 40% and 60% were considered excellent because the difficulty index was maximum at this range. Items with a p-value (difficulty index) of less than 20% (too difficult) and more than 90% (too easy) were not acceptable and need modification. It needed to be conceptualized that a p-value was basically a behavioural measure. Instead of explaining the difficulty in terms of some intrinsic characteristic of the item, the difficulty was defined in terms of the relative frequency with which those taking the test choose the correct response (Thorndike, Cunningham, Thorndike, & Hagen, 1991).

In case the total Cronbach's Alpha value was below the acceptable cut-off of 0.7 (mainly if an index has few items), the mean inter-item correlation was an alternative measure to indicate acceptability. The satisfactory range lied between 0.2 and 0.4.

After the validating process, the 60 test items of each test were revised. The statistical results of the overall test items are shown in Table 10 as follows:

Table 10 The statistical results of the overall test items

Tests	No. of items	Min	Max	Mean	Median	S.D.	p (Difficulty)	R (Discriminatio	∝ (Cronbach's Alpha)
A	60	8	60	29.04	25.00	14.67	0.48	0.51	0.94
B	60	5	60	31.80	32.00	12.83	0.53	0.43	0.93

Table 10 indicates that the difficulty level (p) of those two tests are moderate (p=0.48-0.53) as acceptable. The discrimination level (r) of two tests are higher than acceptable r-value of 0.2 (test A = 0.51, test B = 0.43). Moreover, the two tests' reliability is high; Cronbach's Alpha is 0.94 and 0.93, respectively.

4.3.2 Examining the reliability of trait and state reading comprehension test strategy use questionnaires

Firstly, the reliability of trait and state reading comprehension test strategy use questionnaire used in this study were checked. After having collected the questionnaires of the students, the researcher checked all the papers, adjusted the distribution of score values, and revised the marking scheme based on the students' answers. The reliability of the questions in trait and state reading comprehension test strategy use questionnaires in terms of Cronbach's Alpha were .970 and .985, respectively (N=51).

Table 11 presents the distributions for the trait reading comprehension test strategy use questionnaire. Table 12 shows the internal consistency of the trait reading comprehension test strategy use questionnaire.

Table 11 Distributions for the trait reading comprehension test strategy use questionnaire (N = 168)

Item	Min	Max	Mean	SD	Skewness	Kurtosis
Item 1	1	5	3.01	1.199	0.104	-0.751
Item 2	0	5	3.11	1.209	-0.002	-0.365
Item 3	1	5	3.30	1.041	0.021	-0.533
Item 4	0	5	3.21	1.195	-0.209	-0.230
Item 5	1	5	3.30	1.207	-0.157	-0.871
Item 6	1	5	3.40	1.200	-0.404	-0.619
Item 7	0	5	3.45	1.344	-0.497	-0.508
Item 8	2	5	3.50	0.941	-0.022	-0.877
Item 9	0	5	3.26	1.038	-0.336	0.873
Item 10	1	5	3.45	1.054	-0.370	-0.068
Item 11	1	5	3.46	1.340	-0.447	-0.976
Item 12	1	5	3.73	1.059	-0.656	-0.108
Item 13	0	5	3.88	1.346	-1.113	0.499
Item 14	1	5	3.62	1.208	-0.716	-0.328
Item 15	0	5	3.33	1.145	-0.476	0.269
Item 16	0	5	3.43	1.320	-0.436	-0.646
Item 17	0	5	3.30	1.172	-0.612	0.344
Item 18	1	5	3.62	1.218	-0.402	-0.913
Item 19	1	5	3.60	1.084	-0.435	-0.496
Item 20	0	5	3.34	1.228	-0.477	-0.024
Item 21	1	5	3.40	1.239	-0.205	-0.892
Item 22	0	5	3.25	1.227	-0.529	-0.054
Item 23	2	5	3.83	0.841	-0.398	-0.334
Item 24	0	5	3.26	1.195	-0.626	0.342
Item 25	1	5	3.55	1.014	-0.358	-0.463
Item 26	1	5	3.35	0.942	-0.235	-0.170
Item 27	1	5	3.67	0.951	-0.485	0.437
Item 28	0	5	3.27	0.977	-0.379	1.737
Item 29	1	5	3.20	1.293	-0.131	-1.128
Item 30	1	5	3.43	1.125	-0.180	-0.499
Item 31	0	5	2.33	1.442	0.102	-0.861
Item 32	1	5	3.50	1.371	-0.564	-0.831
Item 33	1	5	3.10	1.112	-0.031	-0.588
Item 34	1	5	3.33	1.065	-0.369	-0.400
Item 35	1	5	3.88	1.101	-0.839	-0.022
Item 36	0	5	3.43	1.343	-0.519	-0.403
Item 37	1	5	3.23	1.162	-0.289	-0.833
Item 38	1	5	3.48	1.061	-0.348	-0.543
Item 39	1	5	3.44	1.187	-0.389	-0.553
Item 40	1	5	3.51	1.168	-0.428	-0.654
Item 41	1	5	3.24	1.012	0.125	-0.625
Item 42	1	5	3.56	1.321	-0.438	-1.055
Item 43	1	5	3.40	1.067	-0.166	-0.873
Item 44	1	5	3.29	1.129	-0.393	-0.445
Item 45	1	5	3.60	1.128	-0.772	0.145
Item 46	1	5	3.26	1.010	0.053	-0.663
Item 47	1	5	3.29	1.011	-0.226	-0.574
Item 48	1	5	3.08	1.086	-0.082	-0.412
Item 49	0	5	2.93	1.282	-0.516	-0.254
Item 50	1	5	3.66	0.972	-0.621	0.026
Item 51	0	5	3.34	1.271	-0.573	-0.332

Table 12 Internal consistency of the trait reading comprehension test strategy use questionnaire (N = 168)

Strategy use	Subscale	No. of items	Items	Internal consistency
Cognitive	Comprehending	6	11, 12, 13, 14, 15, 16	0.865
	Memory	8	17, 18, 19, 20, 21, 22, 23, 24	0.843
	Retrieval	7	25, 26, 27, 28, 29, 30, 31	0.761
Metacognitive	Planning	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	0.96
	Monitoring	14	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45	0.936
	Evaluating	6	46, 47, 48, 49, 50, 51	0.852
		51		0.970

Table 13 presents the distributions for the state reading comprehension test strategy use questionnaire. Table 14 shows the internal consistency of the state reading comprehension test strategy use questionnaire.

Table 13 Distributions for the state reading comprehension test strategy use questionnaire (N = 168)

Item	Min	Max	Mean	SD	Skewness	Kurtosis
Item 1	2	5	4.43	0.801	-1.090	-0.099
Item 2	2	5	4.40	0.911	-1.423	0.957
Item 3	2	5	4.37	0.899	-1.199	0.293
Item 4	1	5	4.13	1.156	-1.060	0.229
Item 5	1	5	4.29	1.029	-1.046	-0.290
Item 6	1	5	3.92	1.035	-1.144	1.139
Item 7	1	5	4.14	0.877	-0.983	0.703
Item 8	2	5	3.83	0.647	-0.891	1.567
Item 9	3	5	4.06	0.740	-0.095	-1.157
Item 10	1	5	3.74	0.998	0.328	-1.424
Item 11	1	5	4.35	0.902	-1.235	0.757
Item 12	2	5	4.48	0.796	-1.145	-0.199
Item 13	2	5	4.51	0.797	-1.314	0.352
Item 14	1	5	4.14	0.758	-0.736	0.960
Item 15	1	5	4.01	0.851	-0.306	-0.622

Table 14 Distributions for the state reading comprehension test strategy use questionnaire (N = 168) (Continued)

Item	Min	Max	Mean	SD	Skewness	Kurtosis
Item 16	2	5	4.58	0.808	-1.634	1.209
Item 17	0	5	4.08	0.836	-0.904	2.097
Item 18	1	5	3.80	0.904	0.154	-1.105
Item 19	2	5	4.08	0.754	-0.309	-0.681
Item 20	1	5	3.95	0.927	-0.406	-0.639
Item 21	1	5	4.19	0.922	-0.946	0.401
Item 22	1	5	3.98	0.947	-1.235	2.037
Item 23	2	5	4.15	0.723	-0.425	-0.348
Item 24	2	5	3.90	0.671	0.001	-0.477
Item 25	2	5	4.13	0.702	-0.389	-0.189
Item 26	2	5	3.92	0.609	-0.121	0.160
Item 27	3	5	4.14	0.686	-0.191	-0.864
Item 28	2	5	4.32	0.883	-0.770	-0.994
Item 29	1	5	4.11	0.785	-0.879	1.606
Item 30	2	5	4.40	0.891	-0.995	-0.716
Item 31	0	5	3.51	1.597	-0.834	-0.341
Item 32	1	5	4.43	0.906	-1.397	1.191
Item 33	1	5	4.32	1.073	-1.277	0.209
Item 34	1	5	4.08	0.841	-1.005	1.138
Item 35	2	5	4.10	0.736	-0.243	-0.831
Item 36	1	5	3.93	0.883	-0.346	-0.267
Item 37	1	5	4.04	0.960	-0.895	0.133
Item 38	2	5	4.32	0.911	-0.827	-0.920
Item 39	1	5	4.48	0.868	-1.388	0.804
Item 40	1	5	4.41	0.905	-1.154	0.074
Item 41	1	5	4.39	0.889	-1.207	0.521
Item 42	1	5	4.09	0.839	-0.847	0.983
Item 43	1	5	3.71	0.551	-1.755	3.769
Item 44	2	5	3.70	0.508	-1.158	0.662
Item 45	1	5	4.01	0.785	-0.386	0.009
Item 46	1	5	4.16	1.063	-0.690	-1.014
Item 47	2	5	3.87	0.899	-0.188	-0.966
Item 48	1	5	3.86	1.051	-0.962	0.421
Item 49	2	5	3.95	0.857	-0.417	-0.522
Item 50	1	5	4.37	0.859	-1.079	0.288
Item 51	0	5	4.27	0.933	-1.290	1.997

Table 15 presents the internal consistency of the state reading comprehension test performance among Thai high school participants of the pilot study. The results showed that 51 questionnaire items were acceptable, indicating the acceptable reliability of internal consistency. These questionnaire items were used to collect the data for the main study.

Table 15 Internal consistency of the state reading comprehension test strategy use questionnaire (N = 168)

Strategy use	Subscale	No. of items	Items	Internal consistency
Cognitive	Comprehending	6	11, 12, 13, 14, 15, 16	0.950
	Memory	8	17, 18, 19, 20, 21, 22, 23, 24	0.945
	Retrieval	7	25, 26, 27, 28, 29, 30, 31	0.808
Metacognitive	Planning	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	0.953
	Monitoring	14	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45	0.969
	Evaluating	6	46, 47, 48, 49, 50, 51	0.958
		51		0.985

4.4 Examining content validity of retrospective interview questions

Content validity examined the extent to which test items measured what they purport to measure (Bachman & Palmer, 2010; Lynn, 1986). Five raters were selected, all raters in the school curriculum with an approximation of 10 years of experience in teaching English as a foreign language (EFL) in Thailand. The raters were instructed to rate the content validity of test items on a Likert scale ranging from -1 to +1 on EFL reading comprehension tests (Hambleton, Swaminathan, Algina, & Coulson, 1978). The raters were instructed to rate -1 when responses did not clearly measure the items, 0 when unsure or unclear, and +1 when it clearly measured the items. The useful property of the coefficient of a scale for each test item were above 0.5. The content validity of different types of tests indicated a validation mean of content validity with reference to Lynn (1986).

4.5 The chapter summary

This chapter provides the extensive snapshot of valuable information, not only for the researcher's main study, but also for other similar studies. Therefore, it is crucial to include complete information on the feasibility of the study. In brief, this chapter reflects the procedures of the pilot study and validates the feasibility of the study by presenting the suitability of the research methods to find the most appropriate method for the main trial. The next chapter will present the quantitative results of the main study.

CHAPTER V
QUANTITATIVE RESULTS AND DISCUSSIONS

This chapter examines the nature of strategic knowledge and strategic regulation of reading comprehension test performance of Thai high school learners. This chapter then reports on the findings of the SEM analyses both cross-sectionally and longitudinally. The chapter also provides a discussion of the quantitative findings of communicative language proficiency (i.e., reading comprehension test performance and strategic competence). To support the claim that L2 reading test performance is complicated, multifaceted, and variable, this chapter provides an analysis and interpretation of the results based on the empirical evidence offered in the SEM analyses. This chapter specifically examines the role of metacognitive and cognitive ability in the context of language assessment. A revised model for assessing strategic competency in language testing is also addressed in this chapter.

5.1 Descriptive statistics of strategy use and reading comprehension test performance

This section reports on the descriptive statistics of the research instruments, including trait and state strategy use and reading comprehension test performance. The quantitative data were analyzed using Statistical Package for the Social Sciences (SPSS) 26.0 software tools. The descriptive and inferential statistics included the mean, standard deviation, and *t*-tests. Before the analyses, the quantitative data were converted into percentages. Percentages were executed to compare across different instruments.

5.1.1 Thai EFL high school learners' cognitive and metacognitive strategy use

This section summarizes the quantitative results of the survey questionnaire about the cognitive and metacognitive methods employed by Thai EFL high school students. One data set was gathered at the commencement of the academic term, and the other was collected at its end. This indicates that the intervals between data collecting points were three months. Furthermore, the questionnaires were administered to all participants twice for each data collection: once for each characteristic and once for each state. In this context, "Trait" denotes the moment the cognitive and metacognitive strategy questionnaire was completed before administering the reading

comprehension test to the participants. “State,” on the other hand, was immediately administered following the reading comprehension exam.

Table 15 illustrates the employment of the trait strategy use questionnaire at Times 1 and 2 on the reading comprehension test (Version A and Version B). Specifically, the results indicated that, at Time 1 (T1), the most frequently used strategy for Thai high school learners was comprehending strategy (62.79%). This was followed by memory (52.81%), planning (52.52%), retrieval (51.10%), and monitoring (51.09%) strategies, respectively. The least used strategy was the evaluating strategy (50.43%). At Time 2 (T2), the results showed that the most frequently used strategy by Thai high school students was the comprehending strategy (68.44%). Among the categorization of cognitive strategies, the most frequently used strategy by Thai EFL high school learners was the comprehending strategy of Time2 or trait 2 (T2) (M=4.11, SD=0.518). This result was followed by memory (61.04%), planning (60.98%), retrieval (58.55%), and monitoring (58.45%) strategies. Thai high school learners' evaluating strategy was the least used (57.66%). These findings indicate that Thai high school learners execute a medium level of trait strategy use on reading test performance.

Regarding the trait strategy use at Time 1, the analysis of the data revealed that Thai EFL high school learners employed cognitive strategy with an average of 3.33 (55.56%) and a standard deviation of 0.542 and used metacognitive strategy with a mean of 3.08 (51.23%) and a standard deviation of 0.558. This finding is similar to that at Time 2; that is, Thai high school learners preferred to use trait cognitive strategies (62.67%; M = 3.76; SD = 0.660) more frequently than trait metacognitive strategy (59.03%; M = 3.54; SD = 0.690). Overall, the results showed that Thai EFL high school learners implemented an average of 3.21 (53.46%) with a standard deviation of 0.535 at Time 1 and an average of 3.65 (60.85%) with a standard deviation of 0.664 at Time 2. These findings indicate that Thai EFL high school learners used a relatively moderate level of trait cognitive and metacognitive strategies on reading tests. Other figures and related results are shown in Table 16. In addition, the findings suggest that Thai high school learners operated cognitive rather than metacognitive strategies.

The paired *t*-test was conducted to determine if there was any significant use of the trait strategy at two different points in time. The analysis of the findings revealed that all pairs of trait strategies used at Times 1 and 2 among Thai EFL high school learners were significantly different. These findings indicate that Thai EFL high school learners improved their awareness of cognitive and metacognitive strategies while doing formal schooling in secondary education.

Table 16 Trait strategy use of reading comprehension test at Time 1 and Time 2

Trait (T1)	Mean	%	Std	Trait (T2)	Mean	%	Std	*t*-test	*p-value*
Comprehending	3.77	62.79	0.548	Comprehending	4.11	68.44	0.518	19.789	.000*
Memory	3.17	52.81	0.604	Memory	3.66	61.04	0.773	16.479	.000*
Retrieval	3.07	51.10	0.653	Retrieval	3.51	58.55	0.800	14.439	.000*
Cognition	*3.33*	*55.56*	*0.542*	*Cognition*	*3.76*	*62.67*	*0.660*	*17.526*	*.000**
Planning	3.15	52.52	0.563	Planning	3.66	60.98	0.610	27.027	.000*
Monitoring	3.07	51.09	0.563	Monitoring	3.51	58.45	0.800	14.177	.000*
Evaluating	3.03	50.43	0.662	Evaluating	3.46	57.66	0.815	14.200	.000*
Metacognition	*3.08*	*51.35*	*0.558*	*Metacognition*	*3.54*	*59.03*	*0.690*	*18.158*	*.000**
Overall	3.21	53.46	0.535	Overall	3.65	60.85	0.664	18.206	.000*

Note: N=685; T = Trait; 1 = Time 1; 2 = Time 2; *Significant at the 0.05 level (p<0.05)

Table 17 illustrates the employment of the state strategy use questionnaire at Times 1 and 2 on the reading comprehension test (Version A and Version B). Specifically, the results indicated that, at Time 1 (S1), the most frequently used strategy for Thai high school learners was comprehending strategy (74.64%). This was followed by monitoring (69.86%), memory (69.73%), retrieval (68.63%), and planning (67.53%) strategies, respectively. The least used strategy was the evaluating strategy (62.42%). At Time 2 (S2), the results showed that the most frequently used strategy by Thai high school students was the comprehending strategy (78.24%). Among the categorization of metacognitive strategies, the most frequently used strategy by Thai EFL high school learners was the comprehending strategy of Time1 or state 1 (S1) (M=4.69, SD=0.601). This result was followed by retrieval (77.45%), monitoring (76.45%), memory (76.34%), and planning (74.44%) strategies. Thai high school learners' evaluating strategy was the least used (65.41%). These findings indicate that Thai high school learners execute a medium level of state strategy use on reading test performance.

Regarding the state strategy use at Time 1, the analysis of the data revealed that Thai EFL high school learners employed cognitive strategy with an average of 4.26 (71.00%) and a standard deviation of 0.842 and used metacognitive strategy with a mean of 4.00 (66.60%) and a standard deviation of 0.815. This finding is similar to that at Time 2; that is, Thai high school learners preferred to use state cognitive strategies (77.34%; M = 4.64; SD = 0.643) more frequently than state metacognitive strategies (72.10%; M = 4.33; SD = 0.578). Overall, the results showed that Thai EFL high school learners implemented an average of 4.13 (68.80%) with a standard deviation of 0.815 at Time 1 and 4.48 (72.72%) with a standard deviation of 0.586 at Time 2. These findings indicate that Thai EFL high school learners used a relatively moderate level of state cognitive and metacognitive strategies on reading tests. Other figures and related results are shown in Table 2. In addition, the findings suggest that Thai high school learners used cognitive rather than metacognitive strategies.

The paired *t*-test was conducted to determine if there was any significant use of the state strategy at two different points in time. The analysis of the findings revealed that all pairs of state strategies at Times 1 and 2 used among Thai EFL high school learners were significantly different. These results demonstrate that Thai EFL students in high school increased their use of cognitive and metacognitive strategies while enrolled in formal secondary education.

Table 17 State strategy use of reading comprehension test at Time 1 and Time 2

State (S1)	Mean	%	Std	State (S2)	Mean	%	Std	*t*-test	*p*-value
Comprehending	4.48	74.64	0.657	Comprehending	4.69	78.24	0.601	26.696	.000*
Memory	4.18	69.73	0.956	Memory	4.58	76.34	0.656	22.607	.000*
Retrieval	4.12	68.63	1.043	Retrieval	4.65	77.45	0.803	19.547	.000*
Cognition	*4.26*	*71.00*	*0.842*	*Cognition*	*4.64*	*77.34*	*0.643*	*24.906*	*.000**
Planning	4.05	67.53	0.765	Planning	4.47	74.44	0.579	31.973	.000*
Monitoring	4.19	69.86	1.028	Monitoring	4.59	76.45	0.689	20.283	.000*
Evaluating	3.75	62.42	0.814	Evaluating	3.92	65.41	0.631	15.008	.000*
Metacognition	*4.00*	*66.60*	*0.815*	*Metacognition*	*4.33*	*72.10*	*0.578*	*26.133*	*.000**
Overall	4.13	68.80	0.815	Overall	4.48	74.72	0.586	27.021	.000*

Note: N=685; S = State; 1 = Time 1; 2 = Time 2; *Significant at the 0.05 level (p<0.05)

Table 18 A summary of cognitive and metacognitive strategy use and reading comprehension test performance by Thai high school learners

Trait (T1)	Mean	%	Std	Trait (T2)	Mean	%	Std	*t*-test	*Sig*
Cognition	3.33	55.56	0.542	Cognition	3.76	62.67	0.660	17.526	.000*
Metacognition	3.08	51.35	0.558	Metacognition	3.54	59.03	0.690	18.158	.000*
Overall	3.21	53.46	0.535	Overall	3.65	60.85	0.664	18.206	.000*
State (S1)	Mean	%	Std	State (S2)	Mean	%	Std	*t*-test	*Sig*
Cognition	4.26	71.00	0.842	Cognition	4.64	77.34	0.643	24.906	.000*
Metacognition	4.00	66.60	0.815	Metacognition	4.33	72.10	0.578	26.133	.000*
Overall	4.13	68.80	0.815	Overall	4.48	74.72	0.586	27.021	.000*

Note: Trait = before test; State = after test

Table 18 summarizes Thai EFL high school learners' cognitive and metacognitive strategy use and reading comprehension test performance. Notably, Thai high school learners executed cognitive strategies more frequently than metacognitive strategies before and after reading comprehension test performance. This result may indicate that Thai EFL high school learners are likely to process information more deeply, transfer and retrieve data to new situations, and result in enhanced and better-retained learning. In other words, Thai EFL high school learners may not be aware of their thinking processes while they use them. The result also showed increased reading comprehension test performance, indicating that Thai EFL high school learners improve their reading comprehension performance with more exposure to language learning.

5.1.2 Thai high school students' reading comprehension test performance

Table 19 illustrates the descriptive statistics of the reading comprehension test scores at Time 1 and Time 2. Specifically, the results indicated that, at Time 1 (Version A), the highest percentage of Thai high school learners' mean scores was LexGrRA2 (41.90%). This was followed by TxtCOMP1 (40.85%) and LexGrRA1 (40.67%), respectively. At Time 2 (Version B), the results showed that Thai high school learners' highest mean score on reading comprehension tests was LexGrRA3 (48.93%). The lowest mean score by Thai EFL high school learners was TxtCOMP2 (45.12%) of Time2. These findings indicate that Thai high school learners' mean scores in each section of the reading comprehension test were significantly lower than half of the total score. In brief, the mean score of reading comprehension test performance at Time 1 was 44.99%, and it was 45.46% at Time 2. These findings

suggest that Thai high school learners gradually improve their reading comprehension due to their relatively low performance on reading comprehension tests.

Table 19 Descriptive statistics of the reading comprehension test performance at Times 1 & 2

Reading comprehension test	Total	Mean	%	Std.	Min	Max
LexGrRA1	10	4.07	40.67	2.293	0	10
LexGrRA2	10	4.19	41.90	2.483	0	9
TxtCOMP1	40	16.34	40.85	6.995	5	32
Version A	**60**	**24.60**	**40.99**	**10.536**	**9**	**46**
LexGrRA3	10	4.89	48.93	2.423	1	10
LexGrRA4	10	4.33	43.34	1.714	2	9
TxtCOMP2	40	18.05	45.12	8.960	3	32
Version B	**60**	**27.28**	**45.46**	**12.007**	**10**	**48**

Note: LexGrRA = Lexical-Grammatical reading ability *TxtCOMP* = Text comprehension ability
LexGrRA1, *LexGrRA*2 and TxtCOMP1 = test version A (Time 1)
LexGrRA3, *LexGrRA*4 and TxtCOMP2 = test version B (Time 2)

5.2 Establishing the structural equation models

This section describes the correlation analyses that examine the interrelationships between the variables of trait and state strategy use and reading comprehension test performance to address the general topic posed. Furthermore, before conducting structural model analysis in SEM studies, the researcher must verify the diversity of all measurement models. Consequently, the subsequent section describes the measurement models that would be incorporated into the structural model.

5.2.1 Trait and state strategy use models in reading comprehension test performance at Time 1

Structural Equation Modeling (SEM) was employed to assess the measurement models, examine the structural models, estimate parameters, model identification, and estimation. Special cases of SEM are regression, canonical correlation, confirmatory factor analysis, and repeated measures analysis of variance (Kline, 1998). SEM can assess the direct and indirect influence. Each measurement model was tested before the structural relationships were finally tested simultaneously because model misfit in

the full latent SEM could initially derive from the misspecification at the level of measurement models.

Evaluation of Model 1

Table 20 illustrates the SEM results of the hypothesized model of the relationship between trait and state strategy use and reading comprehension test performance of Thai high school learners at Time 1 (Model 1). In testing this hypothesized model, it did not fit well with the data. Post hoc fittings (LM test for adding parameters) were then performed. Thus, covariances for non-random measurement errors for these pairs were added in a re-hypothesized model. This modified model was then re-tested, and it was found that the model fitted better with the data. In brief, the re-hypothesized model was acceptable for studying the relationship between trait and state strategy use and reading comprehension test performance at Time 1.

Table 20 The results of the hypothesized model of the relationship between state and trait strategy use and reading comprehension test performance at Time 1: Model 1

Goodness-of-fit criteria	Value
Chi-square (χ^2)	144.27
Degree of Freedom (df)	128
Chi-Square/df (CMIN/df)	1.12
Probability level (p-value)	0.15
Goodness of fit index (GFI)	0.99
Adjusted Goodness of Fit Index (AGFI)	0.95
Comparative Fit Index (CFI)	1.00
Standardized Root Mean square residual (SRMR)	0.07
Root Mean Square Error of Approximation (RMSEA)	0.01

Estimation of Model 1

A review of the unstandardized solution suggests that all estimates were reasonable and statistically significant at the 0.01 level, and all standard errors appeared to be in good order. Table 21 presents the standardized solution of Model 1.

Figure 6 provides a diagrammatic representation of trait and state strategy use at Time 1 (Model 1) in which the standardized parameter estimates are indicated. The loadings in the standardized solution ranged from 0.71 (R^2 = 0.50) for trait comprehending strategy use to 0.92 (R^2 = 0.85) for trait monitoring strategy use. All factor loadings

were statistically significant at the 0.01 level. According to Figure 6, the total common factor variance (h^2: how much of the theoretical construct is explained by the shared common variance in the set of variables loading on the single factor) was 0.838. This indicated that the six variables account for 83.8% of the variance. The unique (residual) factor variance (the amount of variance not explained) was 16.2%. It should be noted that the percentages indicated how much of the theoretical construct was described by the shared common variance in the set of regression coefficients. Moreover, the correlation coefficients between observed variables could be computed by multiplying the weights or factor loadings between pairs of variables. For instance, trait comprehending strategy use and trait evaluating strategy use had a correlation coefficient of 0.32 (i.e., 0.71 x 0.78, large ES) (Cohen, 1992).

The analysis of state strategy use revealed that the standardized solution loadings ranged from 0.77 (R^2 = 0.59) for evaluating strategy use to 0.99 (R^2 = 0.98) for memory strategy use. The total common factor variance was 0.877. This suggests that the six variables explain 87.7% of the factor variance. The unique residual variance (the amount of variance not defined) was 0.133. According to the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.63 for EVA2 and COM2 to 0.91 for MEM2 and MON2. In brief, these findings illustrated in Figure 6 suggest that implementing trait and state strategy indirectly and directly affects Thai high school students' reading comprehension test performance.

Table 21 Standardized parameter estimates for the relationship between trait and state strategy use and reading comprehension test performance at Time 1

Variable	Variable	Direct effect	Error	R^2	f^2 indexes
TCOM1	V1 =	0.71*F1	+ 0.49 E1	0.50	1.02
TMEM1	V2 =	0.88**F1	+ 0.22 E2	0.77	3.43
TRET1	V3 =	0.92*F1	+ 0.15 E3	0.85	5.51
TPLA1	V4 =	0.82*F1	+ 0.33 E4	0.67	2.05
TMON1	V5 =	0.92*F1	+ 0.15 E5	0.85	5.51
TEVA1	V6 =	0.78*F1	+ 0.39 E6	0.61	1.55
SCOM2	V7 =	0.82*F2	+ 0.25 E7	0.67	2.05
SMEM2	V8 =	0.99*F2	+ 0.09 E8	0.98	49.25
SRET2	V9 =	0.90*F2	+ 0.09 E9	0.81	4.26
SPLA2	V10 =	0.86*F2	+ 0.20 E10	0.74	2.84
SMON2	V11 =	0.92*F2	+ 0.11 E11	0.85	5.51
SEVA2	V12 =	0.77*F2	+ 0.31	0.59	1.46

			E12		
S1	F2 =	0.40*F2	+ 0.84 D2	0.16	0.19
RCTP1	F3 =	0.52*F3	+ 0.73 D3	0.27	0.37

Note: F1 = T1 (Trait strategy use Time1), F2 = S1 (State strategy use Time1), T = Trait, S = State
COM = Comprehending, MEM = Memory, RET = Retrieval, PLA = Planning, MON = Monitoring,
EVA = Evaluating, RCTP = Reading comprehension test performance

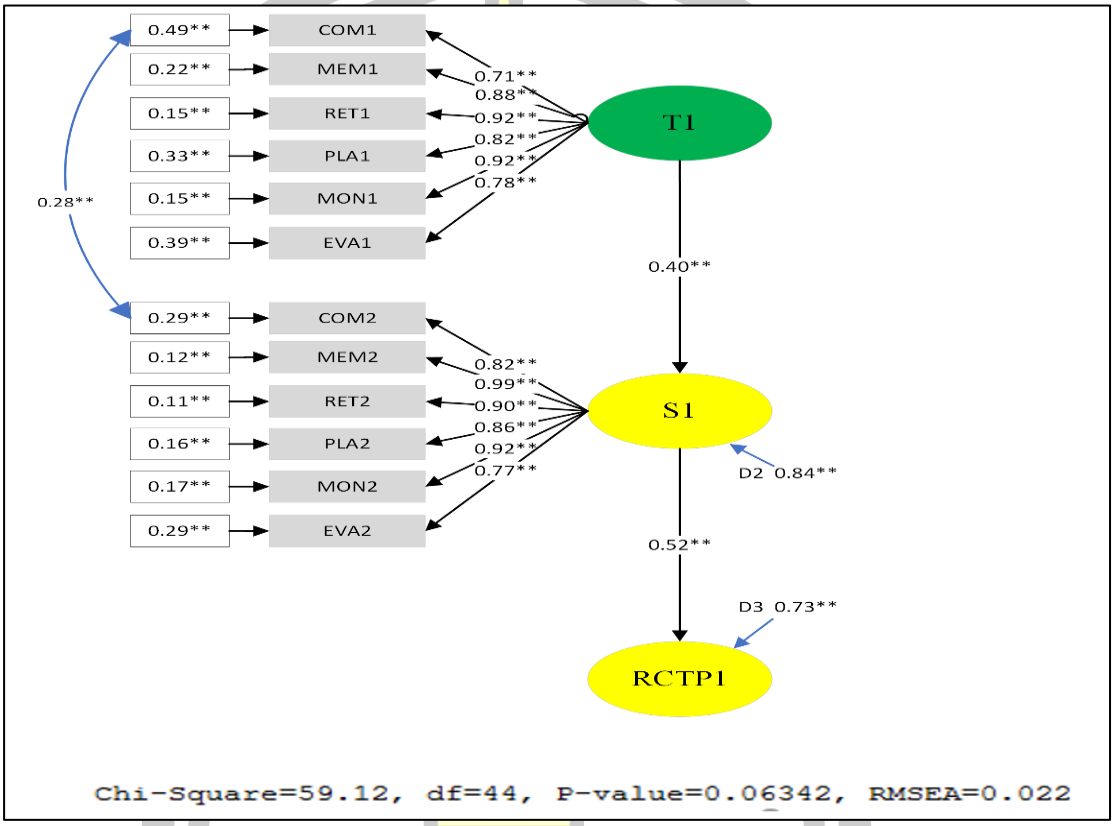


Figure 6 The hypothesized model of the relationship of trait and state strategy use to reading comprehension test performance Time 1 (Model 1)

5.2.2 Trait and state strategy use models in reading comprehension test performance at Time 2

Evaluation of Model 2

Table 22 shows the SEM results of the hypothesized model of the relationship between trait and state strategy use and reading comprehension test performance of Thai high school learners at Time 2 (Model 2). In testing this hypothesized model, it did not fit well with the data. Post hoc fittings (LM test for adding parameters) were then performed. Thus, covariances for non-random measurement errors for these pairs were added in a re-hypothesized model. This modified model was then re-tested, and it was found that the model fitted better with the data. In brief, the re-hypothesized

model was acceptable for studying the relationship between trait and state strategy use and reading comprehension test performance at Time 2.

Table 22 The results of the hypothesized model of the relationship between trait and state strategy use and reading comprehension test performance at Time 2

Goodness-of-fit criteria	Value
Chi-square (χ^2)	144.27
Degree of Freedom (df)	128
Chi-Square/df (CMIN/df)	1.12
Probability level (p-value)	0.15
Goodness of fit index (GFI)	0.99
Adjusted Goodness of Fit Index (AGFI)	0.95
Comparative Fit Index (CFI)	1.00
Standardized Root Mean square residual (SRMR)	0.07
Root Mean Square Error of Approximation (RMSEA)	0.01

Estimation of Model 2

A review of the unstandardized solution suggests that all estimates were reasonable and statistically significant, and all standard errors appeared to be in good order. Table 23 shows the standardized parameter estimates for the relationship between trait and state strategy use and reading comprehension test at Time 2. In addition, Figure 7 provides the diagrammatic representation of Model 2, indicating that all statistical values meet the criteria: (p = 0.15, CMIN/DF = 1.12, GFI = 0.99, AGFI = 0.95, CFI= 1.00, SRMR = 0.07 and RMSEA = 0.01). Overall, all factor loadings were statistically significant at the 0.05 level.

Table 23 Standardized parameter estimates for the relationship between trait and state strategy use and reading comprehension test performance at Time 2

Variable	Variable	Direct effect	Error	R^2	f^2 indexes
TCOM3	V1 =	0.84*F1	+ 0.29 E1	0.70	2.33
TMEM3	V2 =	0.94*F1	+ 0.12 E2	0.88	7.33
TRET3	V3 =	0.94*F1	+ 0.11 E3	0.88	7.33
TPLA3	V4 =	0.92*F1	+ 0.16 E4	0.85	5.67
TMON3	V5 =	0.91*F1	+ 0.17 E5	0.83	4.88
TEVA3	V6 =	0.84*F1	+ 0.29 E6	0.71	2.45
SCOM4	V7 =	0.81*F2	+ 0.30 E7	0.66	1.94
SMEM4	V8 =	0.87*F2	+ 0.24 E8	0.76	3.17
SRET4	V9 =	0.77*F2	+ 0.40 E9	0.59	1.44
SPLA4	V10 =	0.84*F2	+ 0.30 E10	0.71	2.45
SMON4	V11 =	0.88*F2	+ 0.23 E11	0.77	3.35
SEVA4	V12 =	0.81*F2	+ 0.35 E12	0.66	1.94

S2	F2 =	0.97*F2	+ 0.05 D2	0.94	15.67
RCTP2	F3 =	0.16*F3	+ 0.56 D3	0.02	0.02

Note: F1 = TSU2 (Trait strategy use Time2), F2 = SSU2 (State strategy use Time2), T = Trait, S = State
COM = Comprehending, MEM = Memory, RET = Retrieval, PLA = Planning, MON = Monitoring,
EVA = Evaluating, RCTP = Reading comprehension test performance

A review of the unstandardized solution suggests that all estimates were reasonable and statistically significant at the 0.01 level, and all standard errors appeared to be in good order. Table 6 presents the standardized solution of Model 2.

Figure 7 provides a diagrammatic representation of trait and state strategy use at Time 2 (Model 2) in which the standardized parameter estimates are indicated. For trait strategy use, the loadings in the standardized solution ranged from 0.84 (R^2 = 0.70) for planning and evaluating strategy use to 0.94 (R^2 = 0.88) for monitoring and retrieval strategy use. All factor loadings were statistically significant at the 0.01 level. According to Figure 2, the total common factor variance (h^2: how much of the theoretical construct is explained by the shared common variance in the set of variables loading on the single factor) was 0.898. This indicated that the six variables account for 89.8% of the variance. The unique residual variance (the amount of variance not explained) was 10.2%. It should be noted that the percentages indicated how much of the theoretical construct was described by the shared common variance in the set of regression coefficients. Moreover, the correlation coefficients between observed variables could be computed by multiplying the weights or factor loadings between pairs of variables. For instance, trait memory and retrieval strategy use had a correlation coefficient of 0.88 (i.e., 0.94 x 0.94, large ES) (Cohen, 1992).

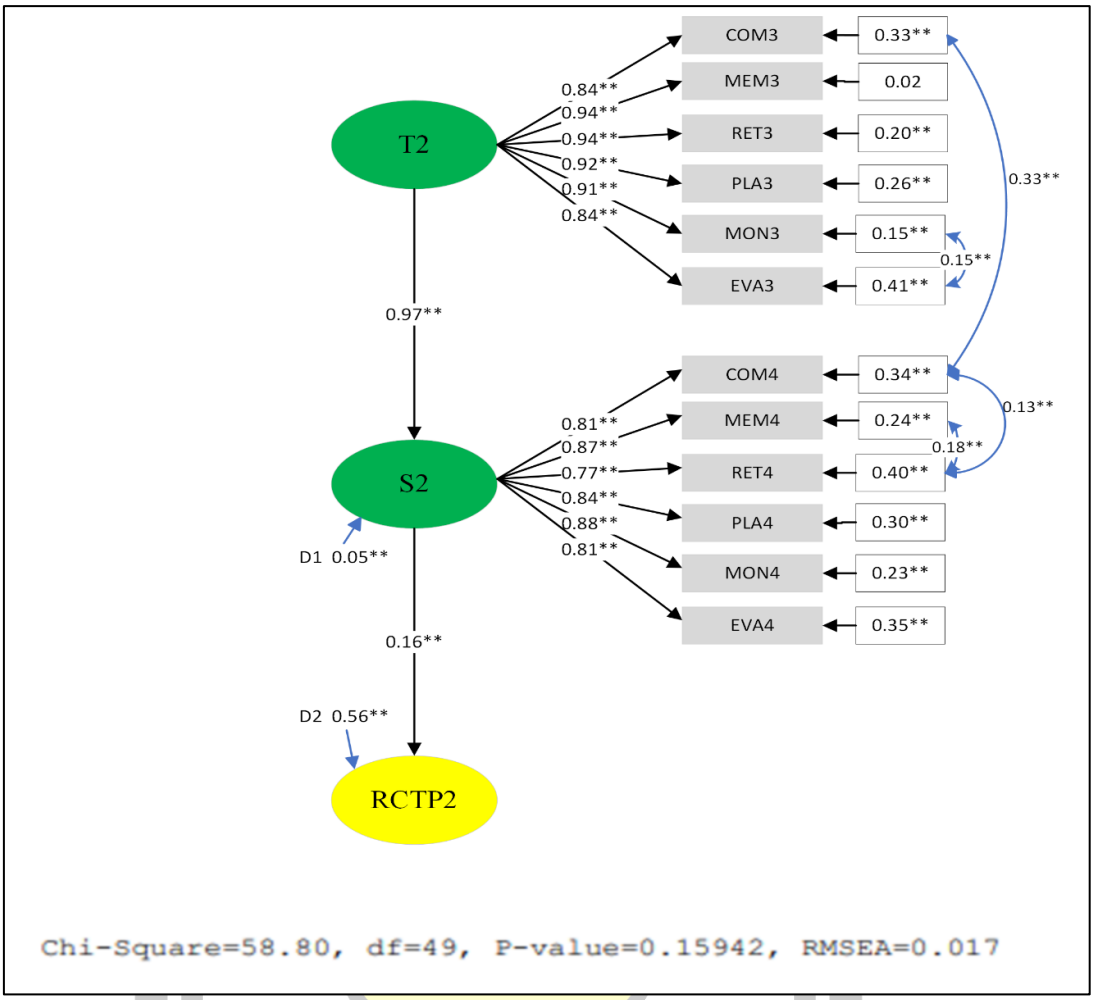


Figure 7 The hypothesized model of the relationship of cognitive and metacognitive strategies to reading comprehension test performance Time 2 (Model 2)

The analysis of state strategy use revealed that the standardized solution loadings ranged from 0.77 (R^2 = 0.59) for state variables: retrieval strategy use to 0.88 (R^2 = 0.77) for state monitoring strategy use. The total common factor variance was 0.830. This suggests that the six variables explain 83.0% of the factor variance. The unique residual variance (the amount of variance not defined) was 17.0%. According to the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.62 for RET4 and EVA4 to 0.76 for MEM4 and MON4. Together, these findings illustrated in Figure 7 suggest that trait and state strategy use indirectly and directly affect Thai high school students' reading comprehension test performance.

5.3 Modelling cognitive and metacognitive strategy use and reading comprehension test performance

5.3.1 Modelling cognitive and metacognitive strategy use and reading comprehension test performance at Time 1 (Model 3)

As discussed in the previous section, strategic knowledge, such as how one perceives using cognitive and metacognitive strategies in a particular way, may influence how one uses them in an actual language context (strategic regulation). Based on this hypothesis, a regression path from trait strategy use Time 1 to state strategy use is added in a structural model (i.e., state strategy use Time 1 was regressed on trait strategy use Time 1). Since state strategy use is part of the overall language processing when test-takers complete a reading comprehension test (i.e., during language use), it was assumed that state strategy use directly influenced language test performance. Based on this, a regression path from state strategy use to reading comprehension test performance was regressed on state strategy use).

In testing the hypothesized model, it was found that model re-specifications might be needed. *Post hoc* fittings (LM test for adding parameters) were conducted. The LM test suggests that correlations between the following variables might be needed: V1 (COM2) and V2 (MEM2), V1 (COM2) and V4 (PLA2), and V1 (COM2) and V6 (EVA2). Following Phakiti's (2007) argument, there might be some redundancy in the cognitive and metacognitive strategy items; hence, non-random errors associated with these variables might be related. According to statistical results in the three abnormally large one-off-diagonal values from the initially hypothesized model results, it was anticipated that the measurement errors of V1, V2, V4 and V6 were to be expected. Thus, covariances for non-random measurement errors for these pairs were added in a re-hypothesized model. This re-hypothesized model was then tested and was observed to fit much better with the data.

It is essential to note that before the current hypothesized model, an alternative SEM model that specified the direct effects of cognitive and metacognitive strategy use on reading comprehension test performance was carried out. It was observed that the data did not explain well, indicating that the hypothesized relationship model is significantly different from the empirical data at the level of .05.

The researcher connects the error values of numerous pairs of variables to alter the model in such a way that all statistical values satisfy the criteria (Figure 3): GFI = 0.99, AGFI = 0.96, CFI = 1.00, SRMR = 0.022, and RMSEA = 0.022. The p-value is 0.628; CMIN/DF is 1.326. The chi-square statistic of the predicted model exhibited a statistically significant probability value (p = 0.628). In contrast to other conventional statistical studies, SEM researchers are required to acquire a nonsignificant value ((2), p > 0.001). The fit indices consistently showed the model fit (RMSEA = 0.049; Bentler-Bonett Non-normed Fit Index = 0.91; CFI = 0.92). 2. Consider, for instance, a Comparative Fit Index (CFI) theoretically set at 0.95. Consequently, the researcher's model exhibits a 95% improvement in relative overall fit when compared to the null model, which was generated using identical sample data. Fit indices of 0.90 indicate that the model is well-fitting (Bentler, 1995). Values of 0.08 or less are preferred for the standardized root mean squared residual (SRMR), which serves as a standardized summary of the average covariance residuals (RMSEA) and the difference between the model implied and observed covariances; when the model is perfectly fitted, these statistics equal zero (Hair et al., 2019).

Evaluation of Model 3

Table 24 illustrates the SEM results of Model 3, which suggest that the hypothesized model was acceptable for examining the relationship between cognitive and metacognitive strategy use and reading comprehension test performance at Time 1.

Table 24 The results of the hypothesized model of the relationship between cognitive and metacognitive strategies and reading comprehension test performance at Time 1

Goodness-of-fit criteria	Value
Chi-square (χ^2)	64.97
Degree of Freedom (df)	49
Chi-Square/df (CMIN/df)	1.32
Probability level (p-value)	0.628
Goodness of fit index (GFI)	0.99
Adjusted Goodness of Fit Index (AGFI)	0.96
Comparative Fit Index (CFI)	1.00
Standardized Root Mean square residual (SRMR)	0.022
Root Mean Square Error of Approximation (RMSEA)	0.022

Estimation of Model 3 at Time 1

A review of the unstandardized solution suggests that estimates were reasonable and statistically significant, and all standard errors appeared to be in good order. Table 25 shows the standardized salutation of Model 3. Figure 8 provides a diagrammatic representation of Model 3, indicating the standardized parameter estimates. The statistically significant correlations ($p < 0.01$) among independent variables (errors) were also found: MEM2 and MON2 (0.21), RET2 and MON2 (0.23), and MON2 and EVA2 (0.19).

Table 25 Standardized parameter estimates for the relationship between cognitive and metacognitive strategies and reading comprehension test performance at Time 1

Variable	Variable	Direct effect	Error	R^2	f^2 indexes
COM2	V1 =	0.90*F1	+ 0.19 E1	0.81	4.26
MEM2	V2 =	0.92*F1	+ 0.15 E2	0.85	5.51
RET2	V3 =	0.90*F1	+ 0.19 E3	0.81	4.26
PLA2	V4 =	0.91*F2	+ 0.17 E4	0.83	4.82
MON2	V5 =	0.77*F2	+ 0.40 E5	0.59	1.46
EVA2	V6 =	0.84*F2	+ 0.30 E6	0.71	2.40
LexGrRA1	V7 =	0.71*F3	+ 0.50 E7	0.50	1.02
LexGrRA2	V8 =	0.80*F3	+ 0.36 E8	0.64	1.78
TextCOMP1	V9 =	0.86*F3	+ 0.26 E9	0.74	2.84
RCTP1	F3 =	0.86*F1 + (-0.58*F2)	+ 0.89 D1	0.07	0.08

Note: F1 = COG1 (Cognitive strategies Time1), F2 = MET1 (Metacognitive strategies Time1), LexGrRA = Lexical-Grammatical reading ability, *TxtCOMP* = Text comprehension ability, RCTP1 = Reading comprehension test performance Time1

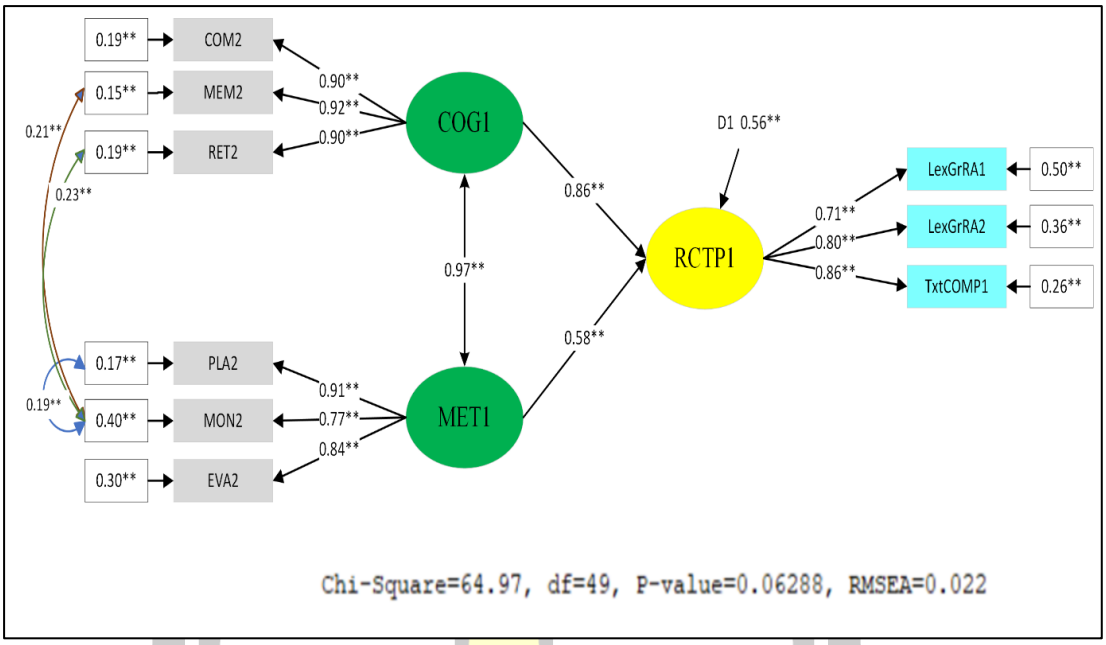


Figure 8 The hypothesized model of the relationship of cognitive and metacognitive strategy use to reading comprehension test performance Time 1 (Model 3)

Based on Figure 8, cognitive and metacognitive strategies' direct and indirect effects on reading comprehension test performance can also be computed. That is, comprehending strategy use positively and directly affected reading comprehension test performance (β = 0.77 [0.90 x 0.86]; R^2 = 0.60; large ES). The degree to which comprehending strategy use affected lexico-grammatical performance 1 (LexGrRA1) was 0.55 (i.e., 0.90 x 0.86 x 0.71; R^2 = 0.30; large ES). Similarly, planning strategy use positively impacted reading comprehension test performance (β = 0.53 [0.91 x 0.58]; R^2 = 0.28; medium ES). Table 26 presents the decomposition of the total effects (direct and indirect effects on reading comprehension test performance at Time 1.

Table 26 Decomposition of the total effects on reading comprehension test performance at Time 1

Variables	Direct and indirect effects
LexGrRA1	0.610 COG1 + 0.71 F3 + (0.58) MET1 + 0.41 E7 + 0.63 D1 *[.71x.86] COG1 + .71 F3[RCTP1] + [(0.58)x .71]MET1 + .47 E7 +[.71x.89]D1*
LexGrRA2	0.68 COG1 + 0.80 F3 + (0.46) MET1 + 0.36 E8 + 0.71 D1
TxtCOMP1	0.74 COG1 + 0.86 F3 + (0.50) MET1 + 0.26 E9 + 0.76 D1
RCTP1	0.86 COG1 + (0.58) MET1 + 0.89 D1

Noted: F3 = reading comprehension test performance Time 1(RCTP1)

5.3.2 Modelling cognitive and metacognitive strategy use and reading comprehension test performance at Time 2

Similar to Model 3, a regression path was incorporated from utilizing cognitive and metacognitive strategies at Time 2 to the performance on the reading comprehension test. The hypothesized model of the association between cognitive and metacognitive strategy utilization and reading comprehension test performance at Time 2 is depicted in Figure 9. (Model 4). When examining this postulated paradigm, analogous outcomes to those of Model 3 were identified. More specifically, the model exhibited a lack of fit with the data. A series of *post hoc* fits (the LM test for parameter addition) was executed. According to the LM test, correlations between the subsequent variables may be necessary: MEM4 and RET4. Therefore, this pair's covariances for non-random measurement errors were included in a re-hypothesised model. The re-evaluation of this re-hypothesized model revealed that it more closely matched the observed data.

Evaluation of Model 4

Table 27 illustrates the SEM results of Model 4, which indicate that the hypothesized model is acceptable.

Table 27 The results of the hypothesized model of the relationship between cognitive and metacognitive strategy use and reading comprehension test performance at Time 2

Goodness-of-fit criteria	Value
Chi-square (χ^2)	64.97
Degree of Freedom (df)	49
Chi-Square/df (CMIN/df)	1.32
Probability level (p-value)	0.628
Goodness of fit index (GFI)	0.99
Adjusted Goodness of Fit Index (AGFI)	0.96
Comparative Fit Index (CFI)	1.00
Standardized Root Mean square residual (SRMR)	0.022
Root Mean Square Error of Approximation (RMSEA)	0.022

Estimation of Model 4

Upon examination of the unstandardized answer, it becomes evident that the estimates were rational and statistically significant, with well-defined standard errors. The standardized solution of Model 4 is illustrated in Table 28, while a diagrammatic representation of Model 4 is presented in Figure 9. In addition, the correlations

between independent variables (errors) that were statistically significant were illustrated: MEM4 and RET4 (0.16). Statistically, all factor loadings were significant at the 0.01 level.

Table 28 Standardized parameter estimates for the relationship between cognitive and metacognitive strategies and reading comprehension test performance at Time 2

Variable	Variable	Direct effect	Error	R^2	f^2 indexes
COM4	V1 =	0.89*F1	+ 0.21 E1	0.79	3.76
MEM4	V2 =	0.88*F1	+ 0.23 E2	0.77	3.35
RET4	V3 =	0.81*F1	+ 0.34 E3	0.66	1.94
PLA4	V4 =	0.87*F2	+ 0.24 E4	0.76	3.17
MON4	V5 =	0.93*F2	+ 0.14 E5	0.86	6.14
EVA4	V6 =	0.83*F2	+ 0.31 E6	0.69	2.23
LexGrRA3	V7 =	0.76*F3	+ 0.43 E7	0.57	1.33
LexGrRA4	V8 =	0.82*F3	+ 0.32 E8	0.67	2.03
TextCOMP2	V9 =	0.70*F3	+ 0.52 E9	0.49	0.96
RCTP2	F3 =	0.14*F1 + 0.33*F2	+ 0.80 D1	0.22	0.28

Note: F1 = COG2 (Cognitive strategies Time1), F2 = MET2 (Metacognitive strategies Time1), LexGrRA = Lexical-Grammatical reading ability, *TxtCOMP* = Text comprehension ability, RCTP2 = Reading comprehension test performance Time2

Figure 9 illustrates that cognitive strategies consist of comprehending, memory, and retrieval strategies. Cognitive strategies were clarified by V1 (comprehending strategies, with a loading factor of 0.89 (R^2 = 0.79), V2(memory strategies, with a loading factor of 0.88 (R^2 = 0.77), and V3 (retrieval strategies, with a loading factor of 0.81 (R^2 = 0.66).

Based on the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.72 (V1 and V3) to 0.78 (V1 and V2). The correlation coefficients among observed variables could be simply computed by multiplying the weights or factor loadings between pairs of variables.

Based on Schumacker and Lomax (1996), the total common factor variance (h^2) that explains how much of the theoretical construct is explained by the shared common variance in the set of variables loading on the single factor was 0.82. Based on Schumacker and Lomax (1996), h^2 can be calculated by squaring each of the weights (factor loadings), summing them up and then dividing the sum by the number of variances. Hence, h^2 of cognitive strategy use is $(0.89^2 + 0.88^2 + 0.81^2)/3 = 0.74$. The unique (residual) factor variance can be computed as 1 - h^2. This indicated that the three variables defined only 74% of the cognitive strategy factor variance. Based on

this, the unique (residual) factor variance accounted for 26%. Standardized factor loadings should have absolute values less than 1.00 for a unidimensional indicator because they are correlations (Kline,1998). This result reveals that although the latent variable has the same scale as one of its indicators, it is not identical to that indicator. Hence, it is almost impossible that the total common factor variance could explain 100% of the latent factor variance. To summarize, comprehending, memory, and retrieval strategies are all related to the nature of cognitive strategies.

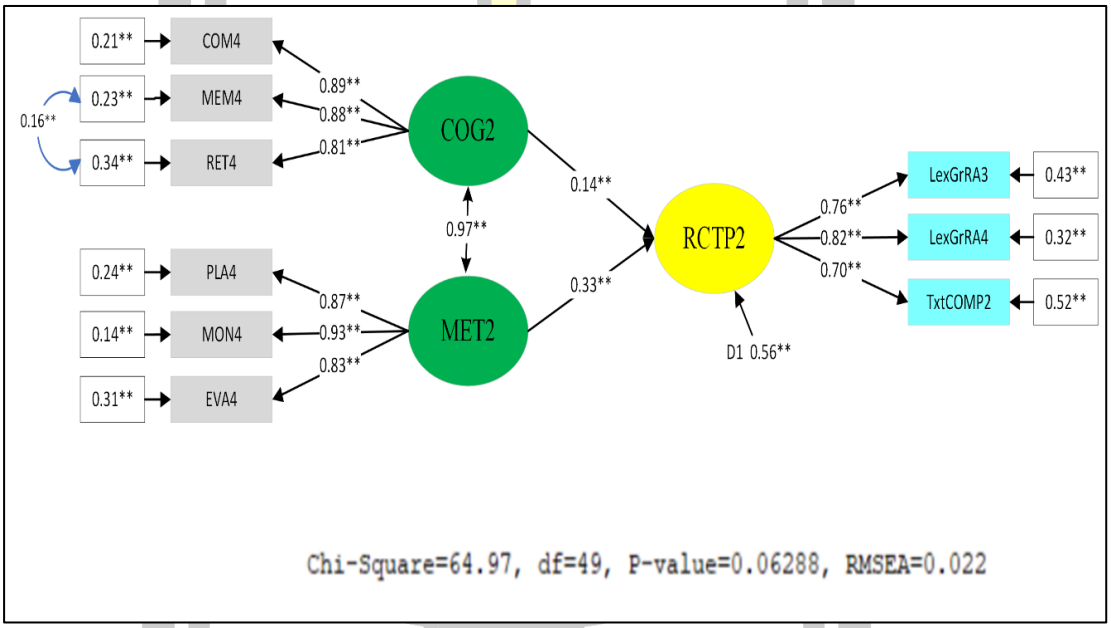


Figure 9 The hypothesized model of the relationship of cognitive and metacognitive strategy use to reading comprehension test performance Time 2 (Model 4)

Based on Figure 9, cognitive and metacognitive strategies' direct and indirect effects on reading comprehension test performance can also be computed. For example, memory strategy positively and directly affected reading comprehension test performance (β = 0.12 [0.88 x 0.14]; R^2 = 0.015; small ES). The degree to which monitoring strategy use affected lexico-grammatical performance 4 (LexGrRA4) was 0.09 (i.e., 0.93 x 0.33 x 0.82; R2 = 0.06; small ES). Similarly, Retrieval strategy use positively impacted reading comprehension test performance (β = 0.11 [0.81 x 0.14]; R2 = 0.13; small ES), indicating that retrieval strategy use accounted for 13% of the reading comprehension test performance variance in Thai high school participants.

Table 28 presents the decomposition of the total effects (direct and indirect effects on reading comprehension test performance at Time 2.

Table 29 Decomposition of the total effects on reading comprehension test performance at Time 2

Variables	Direct and indirect effects
LexGrRA3	0.11 COG2 + 0.76 F3 + 0.25 MET2 + 0.43 E7 + 0.60 D1 [.14x.76] COG2 + .76 F3[RCTP2] + [0.33 x .76]MET2 + .43 E7 +[.76x.80]D1
LexGrRA4	0.09 COG2 + 0.70 F3 + 0.27 MET2 + 0.32 E8 + 0.65 D1
TxtCOMP2	0.098 COG2 + 0.70 F3 + 0.23 MET2 + 0.52 E9 + 0.56 D1
RCTP2	0.14 COG2 + 0.33 MET2 + 0.80 D1

Noted: F1 = COG2 (Cognitive strategies Time2), F2 = MET2 (Metacognitive strategies Time2), LexGrRA = Lexical-Grammatical reading ability, *TxtCOMP* = Text comprehension ability, F3 = reading comprehension test performance Time 2(RCTP2)

5.3.3 Modelling cognitive and metacognitive strategy use and reading comprehension test performance at Time 1

Before testing the structural relationships simultaneously, each measurement model was assessed for fit, as an initial model mismatch in the complete latent SEM might potentially arise from misspecification at the measurement model level. After defining each measurement model, its plausibility was assessed using sample data that included all observed variables. The maximum likelihood (ML) estimation method was employed to estimate the models in the current investigation due to the observed variables' ordinally scaled and multivariate normal nature. ML estimation is commonly employed to identify parameters that accurately reproduce the estimated variance-covariance matrix of the population. Typically, model adequacy is assessed by examining standardized residual values, chi-square statistics, and other fit indices. Additionally, researchers' understanding of the data and the theoretical and conceptual aspects of the investigated constructs are considered (see, e.g., Bentler, 1995; Byrne, 1994; Schumacker & Lomax, 1996, for an extensive discussion of these criteria). Certain constructs first considered represented by certain observed variables were subsequently omitted from certain measurement models. As stated in Table 14, the items to be removed were fourteen variables: V6, V8, V10, V13, V14, V19, V21, V22, V23, V24, V47, V49, V50, and V51.

Following the establishment of measuring models, an investigation was conducted to ascertain the direct impact of metacognitive strategies on cognitive strategies. To accomplish this, an estimate was made for a path coefficient that regressed from

cognitive strategies to metacognitive strategies (i.e., cognitive strategies were regressed on metacognitive strategies). Then, an estimated route coefficient from cognitive strategies to EFL reading test performance was derived by regression. The first hypothesized model, as seen in Figure 1, was determined to be inadequate in fitting the data. As a result, other competing SEM models were evaluated and reevaluated (see Bentler, 2006, for model re-specification). Errors in the utilization of specific metacognitive and cognitive strategies were rectified in this study (see Figure 7). Following the recommendation of Bentler (2006), the variances in shared errors caused by the contents of the measures could be rectified using error correlation, hence enhancing the model's explanatory power.

Figure 10 illustrates the full-latent SEM model that best represents the data in the current study. The independence chi-square statistic (χ^2) was 186537.75. The Chi-square statistic of the hypothesized SEM model (χ^2) was 99053.55. The large difference in the chi-square values between the independence and tested models suggests that the tested model fits well. The probability value for the chi-square statistic of the hypothesized model was significant ($p = 0.000$). Unlike other standard statistical analyses, SEM researchers need to obtain a nonsignificant χ^2 ($p > 0.001$). The fit indices consistently indicated a good model fit (e.g., CFI = 0.90). The fit index of 0.90 suggests a good model fit (Bentler, 1995; Hair et al., 2019). An examination of the appropriateness or feasibility of parameter estimates and the statistical significance of parameter estimates indicated that all estimates were reasonable and statistically significant at the 0.05 level.

The standardized solution of this model and the R^2 value are displayed in Table 31. An example of a suitable category of magnitude-of-effect (ME) estimations associated with the SEM approach is the use of R^2 (Stevens, 1992), provided that the units of measurement have practical significance. The ME measure incorporates an indicator that calculates proportions of variance, which indicate the extent to which the variation in the independent variable accounts for the variability in the dependent variable (s). The range of magnitudes is 0 to 1. According to the taxonomy, names were assigned to the observed items (refer to Table 31) for communication. For instance, the designation "PLA1" for V1 stood for "plan before began to read."

Table 30 Observed variables with standardized values lower than 0.30 on Time 1

Variable	Name	Label	Loading
V6	PLA6	quickly scan the test	0.06
V8	PLA8	glance at the text to understand what it is about	0.08
V10	PLA10	look at the test a few times to see how it went	0.10
V13	COM3	skip unknown words	0.15
V14	COM4	look for words or phrases	0.18
V19	MEM3	read the text repeatedly until you understand	0.26
V21	MEM5	use the first language to translate text	0.28
V22	MEM6	grasp some points for understanding	0.25
V23	MEM7	read the text and infer	0.26
V24	MEM8	sum up the important part	0.24
V47	EVA2	evaluate my performance and progress	0.29
V49	EVA4	take notes	0.25
V50	EVA5	restate in your own words	0.21
V51	EVA6	evaluate the text	0.23

Table 31 Standardized parameter estimates for cognitive and metacognitive strategies and reading comprehension test performance at Time 1

Variable	Name	Label	Loading	Error	R^2
V1	PLA1	plan before reading	0.94*F1	+0.12 E1	0.88
V2	PLA2	understand the goal of the task	0.84*F1	+0.29 E2	0.71
V3	PLA3	think about what to achieve	0.83*F1	+0.31 E3	0.69
V4	PLA4	know what to do and how to do	0.80*F1	+0.35 E4	0.65
V5	PLA5	realize whether or not plans work well	0.82*F1	+0.33 E5	0.67
V7	PLA7	identify purposes	0.76*F1	+0.42 E7	0.58
V9	PLA9	highlight the length and arrangement of a text	0.75*F1	+0.43 E9	0.57
V11	COM1	look for the main idea in the first sentence	0.99*F4	+0.02 E11	0.98
V12	COM2	figure out the link to the main ideas	0.99*F4	+0.01 E12	0.99
V15	COM5	Predict what will happen next	0.97*F4	+0.06 E15	0.94
V16	COM6	interpret the author's intended message	0.97*F4	+0.05 E16	0.95

Table 32 Standardized parameter estimates for cognitive and metacognitive strategies and reading comprehension test performance at Time 1 (continued)

Variable	Name	Label	Loading	Error	R^2
V17	MEM1	use typographic features	0.99*F5	+0.04 E17	0.96
V18	MEM2	reread the text to understand it better	0.90*F5	+0.20 E18	0.80
V20	MEM4	try to decipher hidden concepts	0.88*F5	+0.22 E19	0.78
V25	RET1	use prior knowledge	0.94*F6	+0.04 E25	0.96
V26	RET2	aware of relevant information	0.95*F6	+0.04 E26	0.96
V27	RET3	use context clues	0.97*F6	+0.06 E27	0.94
V28	RET4	use the grammar rules	0.97*F6	+0.07 E28	0.93
V29	RET5	know root words	0.96*F6	+0.07 E29	0.93
V30	RET6	infer the information	0.98*F6	+0.04 E30	0.96

V31	RET7	comprehend from prior knowledge	0.90*F6	+0.19 E31	0.81
V32	MON1	aware of the time limitations	1.00*F2	+0.01 E32	0.99
V33	MON2	aware of the amount of reading and tasks	0.84*F2	+0.29 E33	0.71
V34	MON3	aware of when and where it is confusing	0.88*F2	+0.23 E34	0.77
V35	MON4	know when you get anxious or uninterested	0.85*F2	+0.28 E35	0.72
V36	MON5	know when losing attention	0.78*F2	+0.38 E36	0.62
V37	MON6	double-check, or self-reflect	0.83*F2	+0.32 E37	0.68
V38	MON7	aware of whether or not you comprehend the text	0.86*F2	+0.25 E38	0.75
V39	MON8	pay attention to necessary detail	0.86*F2	+0.25 E39	0.75
V40	MON9	adapt reading speed	0.88*F2	+0.32 E40	0.68
V41	MON10	manage the time	0.78*F2	+0.39 E41	0.61
V42	MON11	correct mistake effectively	0.81*F2	+0.34 E42	0.66
V43	MON12	adjust reading speed	0.80*F2	+0.35 E43	0.65
V44	MON13	adapt the pace of answering	0.80*F2	+0.36 E44	0.64
V45	MON14	use context clues	0.84*F2	+0.30 E45	0.70
V46	EVA1	prove comprehension of the task	0.90*F3	+0.19 E46	0.81
V48	EVA3	evaluate reading strategies	0.53*F3	+0.72 E48	0.28
V52	LexGrRA1	Lexical-Grammatical reading ability1	0.53*F7	+0.72 E52	0.87
V53	LexGrRA2	Lexical-Grammatical reading ability2	0.53*F7	+0.72 E53	0.92
V54	TxtCOMP1	Text comprehension ability1	0.53*F7	+0.72 E54	0.90
F4	Com	Comprehending strategies	0.18*F1 +0.18*F2 +0.18*F3 +0.45*F6	+0.06 D1	0.94

Table 33 Standardized parameter estimates for cognitive and metacognitive strategies and reading comprehension test performance at Time 1 (continued)

Variable	Name	Label	Loading	Error	R^2
F6	Retrieval	Retrieval strategies	0.20*F1 +0.20*F2 +0.20*F3 +0.33*F5	+0.18 D3	0.82
F7	RCTP1	RCTP1 strategies	0.36*F4 +0.22*F5 +0.33*F6	+0.22 D4	0.78

Based on Figure 10, it was discovered that there was only one-way communication between the comprehension, memory, and retrieval strategies. That is to say, the relationship was not reciprocal, as was first believed. First, based on the testing and retesting of the hypothesized SEM model, it was found that memory strategies influenced the extent to which retrieval strategies were to be used. The regression coefficient of memory strategies on retrieval strategies was 0.33 (R^2=0.11). Second, memory strategies indirectly affected comprehending strategies through retrieval strategies (regression coefficient = 0.15(0.33x0.45); R^2=0.02). Third, retrieval strategies largely affected comprehending strategies (regression coefficient = 0.45; R^2=0.20). This means that comprehending strategies depends largely on the effectiveness of retrieval strategies, as shown in Figure 11.

Figure 11 shows that cognitive strategies consist of comprehending, memory, and retrieval strategies. *Comprehending strategies* were explained by V11 (look at the first sentence for the main idea, with a loading factor of 0.99 (R^2=0.98), V12(figure out the link of the main ideas, with a loading factor of 0.99 (R^2=0.99), V15 (think about what to complete, with a loading factor of 0.97 (R^2=0.94), and V16 (interpret what the author tried to communicate, with a loading factor of 0.97 (R^2 = 0.95). Based on the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.94 (V15 and V16) to 0.98 (V11 and V12). The correlation coefficients among observed variables could be simply computed by multiplying the weights or factor loadings between pairs of variables. The total common factor variance (h^2) of comprehending strategy is (0.98 + 0.99 + 0.94 + 0.95)/4 = 0.96. This indicated that the four variables defined 96% of the comprehending strategy factor variance. Based on this, the unique (residual) factor variance accounted for 4% of the total variance. In summary, comprehending strategies are related to looking at the first sentence for the main idea, figuring out the main ideas' link, thinking about what would happen next, and interpreting what the author tried to communicate.

Memory strategies were explained by V17 (use typographic features, with a loading factor of 0.99 (R^2=0.96), V18 (reread text to understand better, with a loading factor of 0.90 (R^2=0.80), and V20 (try to decipher hidden concepts, with a loading factor of

0.88 (R^2 = 0.78), Based on the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.79 (V18 and V20) to 0.89 (V17 and V18). The memory strategy's total common factor variance (h^2) is (0.96 + 0.80 + 0.78)/3 = 0.85. This indicated that the three variables accounted for 85% of the memory strategy factor variance. Based on this, the unique (residual) factor variance accounted for 15% of the total variance. In summary, memory strategies involve using typographic features, rereading text to understand better, and deciphering hidden concepts.

Retrieval strategies were explained by V25 (use prior knowledge, with a loading factor of 0.94 (R^2=0.96), V26 (be aware of relevant information, with a loading factor of 0.95 (R^2=0.96), V27 (use context clues, with a loading factor of 0.97 (R^2=0.94), V28 (use the grammar rules, with a loading factor of 0.97 (R^2=0.93), V29 (know root words, with a loading factor of 0.96 (R^2=0.93), V30 (infer the information, with a loading factor of 0.98 (R^2=0.96) and V31 (comprehend from prior knowledge, with a loading factor of 0.90 (R^2=0.81). Based on the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.85 (V25 and V31) to 0.95 (V28 and V30). The total common factor variance (h^2) of planning strategy is (0.96 + 0.96 + 0.94 + 0.93 + 0.93 +0.96 + 0.81)/7 = 0.93. The seven variables explained 93% of the retrieval strategy factor variance. Based on this, the unique (residual) factor variance accounted for 7% of the total variance. In summary, retrieval strategies are related to using prior knowledge, being aware of relevant information, using context clues and grammar rules, knowing root words, inferring the information, and comprehending from prior knowledge.

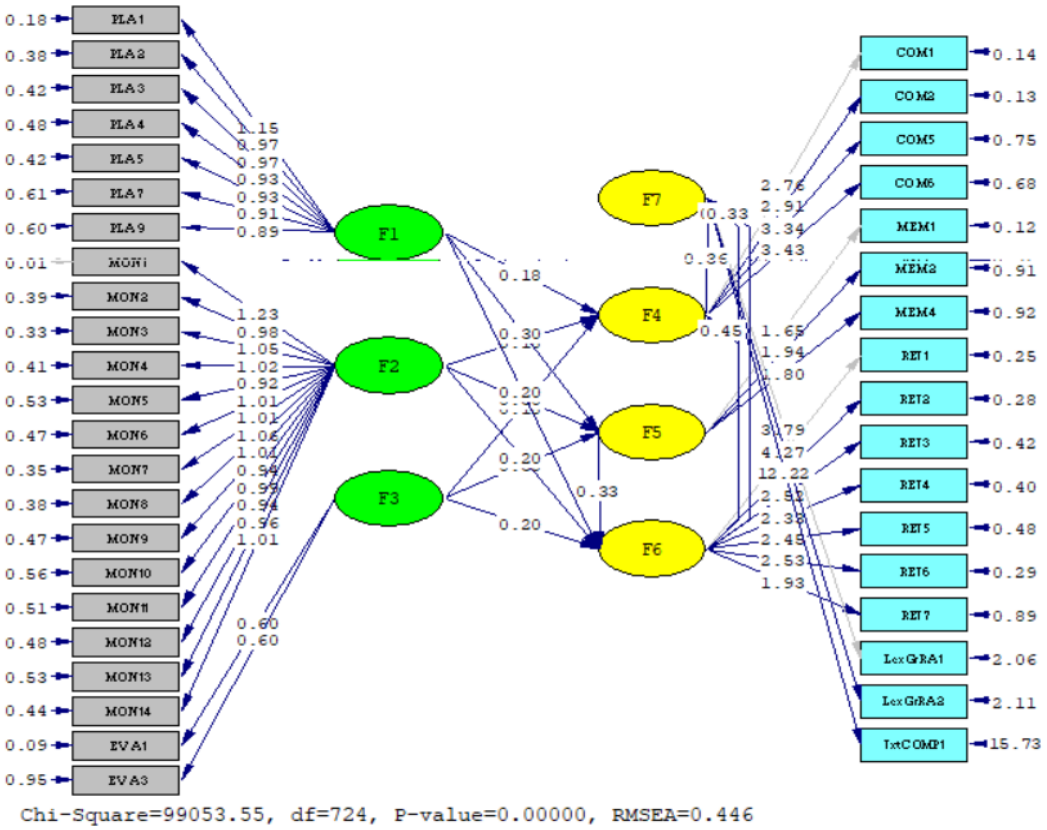
Planning strategies were explained by V1 (plan before beginning to read, with a loading factor of 0.94 (R^2=0.88), V2(understand the goal of the task, with a loading factor of 0.84 (R^2=0.71), V3 (think about what to complete, with a loading factor of 0.83 (R^2 = 0.69), V4 (know what to do and how to do, with a loading factor of 0.80 (R^2=0.65), V5 (know what to do if the plan did not work well, with a loading factor of 0.82 (R^2=0.67), V7 (test questions to identify purposes, with a loading factor of 0.76 (R^2=0.58) and V9 (highlight the length and arrange the text, with a loading factor of 0.75 (R^2=0.57). Based on the computation of correlation coefficients among these

observed strategies, the correlation coefficients ranged from 0.57 (V7 and V9) to 0.79 (V1 and V2). The total common factor variance (h^2) of planning strategy is (0.88 + 0.91 + 0.69 + 0.65 + 0.67 +0.58 + 0.57)/7 = 0.71. This indicated that the seven variables accounted for 71% of the planning strategy factor variance. Based on this, the unique (residual) factor variance accounted for 29% of the total variance. In summary, planning strategies are related to plan before beginning to read, understanding the goal of the task, thinking about what to complete, knowing what to do and how to do it, test questions to identify purposes, and highlighting the length and arrangement of the text.

Monitoring strategies were explained by V32 (be aware of the time limitations, with a loading factor of 1.00 (R^2=0.99), V33 (be aware of the amount of reading and tasks, with a loading factor of 0.84 (R^2=0.71), V34 (be aware of when and where of confusing, with a loading factor of 0.88 (R^2=0.77), V35 (realize when get anxious, tense or uninterested, with a loading factor of 0.85 (R^2=0.72), V36 (know when losing attention, with a loading factor of 0.78 (R^2=0.62), V37 (double-check, or self-reflect, with a loading factor of 0.83 (R^2 = 0.68), V38 (be aware of whether or not comprehend the text, with a loading factor of 0.86 (R^2=0.75), V39 (know to pay more attention), with a loading factor of 0.86 (R^2=0.75), V40 (know when to speed up in reading, with a loading factor of 0.88 (R^2=0.68), V41 (manage the time, with a loading factor of 0.78 (R^2=0.61), V42 (correct mistake quickly, with a loading factor of 0.88 (R^2 = 0.66), V43 (adapt reading speed, with a loading factor of 0.80 (R^2=0.65), V44 (adapt the pace of answering, with a loading factor of 0.80 (R^2=0.64) and V45 (use context clues to enhance reading ability, with a loading factor of 0.84 (R^2=0.70). Based on the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.61 (V36 and V41) to 0.88 (V32 and V35). The total common factor variance (h^2) of monitoring strategy is (0.99 + 0.71 + 0.77 + 0.72 + 0.62 +0.68 + 0.75 + 0.75 + 0.68 + 0.61 + 0.66 + 0.65 + 0.64 + 0.70)/14 = 0.71. This indicated that the fourteen variables described 71% of the monitoring strategy factor variance. Based on this, the unique (residual) factor variance accounted for 29% of the total variance. In summary, monitoring strategies are related to plan before beginning, being aware of the time limitations, being aware

of the amount of reading and tasks, being aware of when and where it is confusing, realizing when get anxious, tense or uninterested, knowing when losing attention, double-check, or self-reflect, be aware of whether or not comprehend the text, know to pay more attention, know when to speed up in reading, manage the time, correct mistake quickly, adapt reading speed, and use context clues to enhance reading ability.

Evaluating strategies were explained by V46 (can prove comprehension of the task, with a loading factor of 0.90 (R^2=0.81) and V48 (evaluate reading strategies, with a loading factor of 0.53 (R^2=0.28). Based on the computation of correlation coefficients among these observed strategies, the correlation coefficients ranged from 0.23 (V46 and V48). The evaluating strategy's total common factor variance (h^2) is (0.81 + 0.28)/2 = 0.54. This indicated that the two variables accounted for 54% of the memory strategy factor variance. Based on this, the unique (residual) factor variance accounted for 46% of the total variance. In brief, evaluating strategies involves proving comprehension of the task and evaluating reading strategies.



Note: F1 = planning strategies, F2 = monitoring strategies, F3 = evaluating strategies,
F4 = Comprehending Strategies, F5 = Memory Strategies, F6 = Retrieval Strategies,
F7 = reading comprehension test performance.

Figure 10 The hypothesized model of the interrelationship among cognitive and metacognitive strategies to reading comprehension test performance Time 1 (Model 5)

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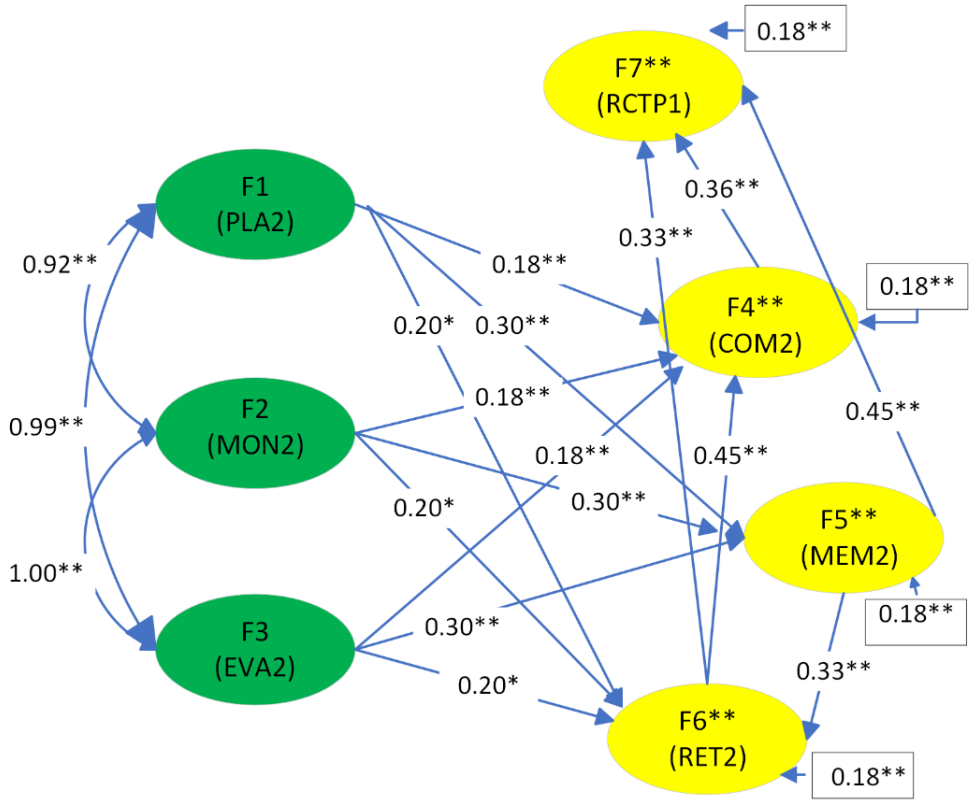


Figure 11 The hypothesized model of the relationships of cognitive and metacognitive strategies in real-time to reading comprehension test performance Time 1 (Model 6)

5.3.4 Modelling cognitive and metacognitive strategy use and reading comprehension test performance at Time 2

Figure 12 presents the re-hypothesized reading comprehension test performance model at Time 2 and the application of cognitive and metacognitive strategies (Model 7). A regression path, similar to Model 5, from metacognitive strategies on cognitive strategies to reading comprehension test performance. The results of testing this model were similar to those of Model 5. To put it another way, there was a poor match (i.e., factor loading of less than 0.30) between the model and the data. Subsequently, fourteen variables (questionnaire items) are to be eliminated: V6, V8, V10, V13, V14, V17, V18, V19, V20, V21, V22, V23, V24, and V46, as detailed in Table 16. After the second test of this re-hypothesized model, it better suited the data.

The full-latent SEM model that best describes the data in the current research is also shown in Figure 12. The chi-squared statistic (χ^2) for independence was 136443.15. The chi-squared statistic for this revised SEM model(χ^2) was 83999.76. The tested

model fits well because there is a significant difference in the chi-square values between the independence and tested models (p=0.000). Unlike other standard statistical analyses, SEM researchers need to produce a nonsignificant χ^2 ($p > 0.001$). Fit indices, such as Bentler-Bonett Non-normed Fit Index = 0.90; CFI = 0.91, consistently showed a good model fit (Bentler, 1995; Hair et al., 2019).

Table 34 Observed variables with standardized values lower than 0.30 on Time 2

Variable	Name	Label	Loading
V6	PLA6_2	quickly scan the test	0.10
V8	PLA8_2	glance at the text to understand what it was about	0.10
V10	PLA10_2	look at the test a few times to see how it went	0.11
V13	COM3_2	skip unknown words	0.22
V14	COM4_2	look for words or phrases	0.21
V17	MEM1_2	use typographic features	1.15
V18	MEM2_2	reread the text to understand it better	0.25
V19	MEM3_2	read the text repeatedly until you understand	0.09
V20	MEM4_2	try to decipher hidden concepts	0.06
V21	MEM5_2	use first language to translate text	0.18
V22	MEM6_2	grasp some points for understanding	0.17
V23	MEM7_2	read the text and infer	0.16
V24	MEM8_2	sum up the most important part	0.14
V46	EVA1_2	prove comprehension of the task	1.02

Table 33 shows the model's standardized solution and the R^2 value. For communication purposes, names, including labels, were given to the observed variables according to the taxonomy. For example, "PLA1_2" for V1 is called "plan before reading".

Table 35 Standardized parameter estimates for cognitive and metacognitive strategies and reading comprehension test performance at Time 2

Variable	Name	Label	Loading	Error	R^2
V1	PLA1_2	plan before reading	0.84*F1	+0.30 E1	0.88
V2	PLA2_2	understand the goal of the task	0.78*F1	+0.40 E2	0.71
V3	PLA3_2	think about what to achieve	0.78*F1	+0.39 E3	0.69
V4	PLA4_2	know what to do and how to do	0.79*F1	+0.38 E4	0.65
V5	PLA5_2	realize whether or not plans work well	0.79*F1	+0.38 E5	0.67
V7	PLA7_2	identify purposes	0.74*F1	+0.45 E7	0.58
V9	PLA9_2	highlight the length and arrangement of a text	0.72*F1	+0.48 E9	0.57

V11	COM1_2	look for the main idea in the first sentence	0.81*F4	+0.34 E11	0.98
V12	COM2_2	figure out the link to the main ideas	0.81*F4	+0.34 E12	0.99
V15	COM5_2	predict what will happen next	0.75*F4	+0.44 E15	0.94
V16	COM6_2	interpret the author's intended message	0.74*F4	+0.45 E16	0.95
V25	RET1_2	use prior knowledge	0.82*F6	+0.33 E25	0.96

Table 36 Standardized parameter estimates for cognitive and metacognitive strategies and reading comprehension test performance at Time 2 (Continued)

Variable	Name	Label	Loading	Error	R^2
V26	RET2_2	aware of relevant information	0.81*F6	+0.34 E26	0.80
V27	RET3_2	use context clues	0.80*F6	+0.36 E27	0.78
V28	RET4_2	use the grammar rules	0.80*F6	+0.36 E28	0.96
V29	RET5_2	know root words	0.79*F6	+0.37 E29	0.96
V30	RET6_2	infer the information	0.82*F6	+0.33 E30	0.94
V31	RET7_2	comprehend from prior knowledge	0.79*F6	+0.43 E31	0.93
V32	MON1_2	aware of the time limitations	082*F2	+0.33 E32	0.93
V33	MON2_2	aware of the amount of reading and tasks	0.82*F2	+0.33 E33	0.96
V34	MON3_2	aware of when and where it is confusing	0.79*F2	+0.37 E34	0.81
V35	MON4_2	know when you get anxious or uninterested	0.79*F2	+0.37 E35	0.99
V36	MON5_2	know when losing attention	0.77*F2	+0.41 E36	0.71
V37	MON6_2	double-check or self-reflect	0.76*F2	+0.43 E37	0.77
V38	MON7_2	aware of whether or not you comprehend the text	0.78*F2	+0.39 E38	0.72
V39	MON8_2	pay attention to necessary detail	0.79*F2	+0.38 E39	0.62
V40	MON9_2	adapt reading speed	0.79*F2	+0.38E 40	0.68
V41	MON10_2	manage the time	0.74*F2	+0.45E4 1	0.55
V42	MON11_2	correct mistake effectively	0.78*F2	+0.40 E42	0.60
V43	MON12_2	adjust reading speed	0.76*F2	+0.42 E43	0.58
V44	MON13_2	adapt the pace of answering	0.76*F2	+0.42 E44	0.58
V45	MON14_2	use context clues	0.77*F2	+0.40 E45	0.60

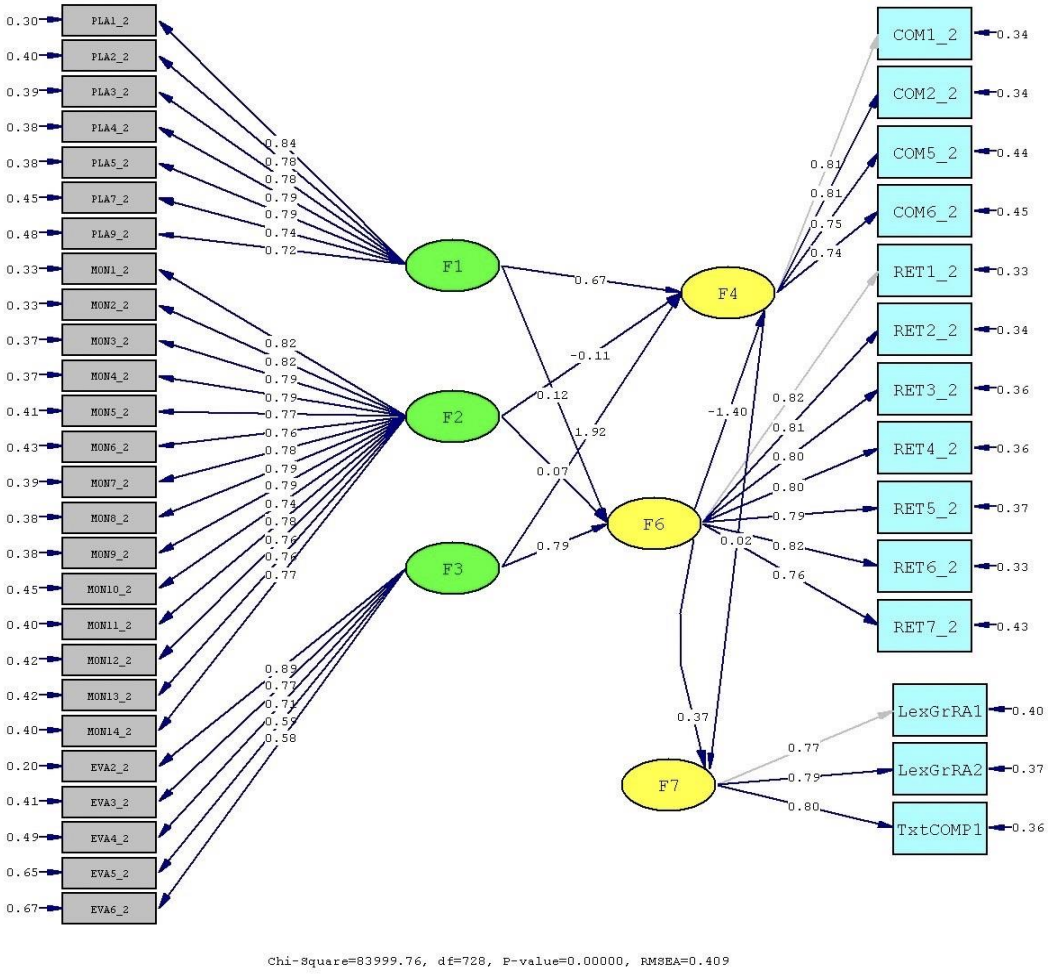
V47	EVA2_2	evaluate my performance and progress	0.89*F2	+0.20 E47	0.80
V48	EVA3_2	evaluate reading strategies	0.77*F2	+0.41 E48	0.59
V49	EVA4_2	take notes	0.71*F2	+0.49 E49	0.51
V50	EVA5_2	restate in your own words	0.59*F2	+0.65 E50	0.35
V51	EVA6_2	evaluate the text	0.58*F2	+0.67 E51	0.33
V52	LexGrRA3	Lexical-Grammatical reading ability3	0.53*F7	+0.72 E52	0.87
V53	LexGrRA4	Lexical-Grammatical reading ability4	0.53*F7	+0.72 E53	0.92
V54	TxtCOMP2	Text comprehension ability2	0.53*F7	+0.72 E54	0.90
F4	Comprehending	Comprehending strategies	0.18*F1 +0.18*F2 +0.18*F3 +0.45*F6	+0.06 D1	0.94
F5	Memory	Memory strategies	0.30*F1 +0.20*F2 +0.30*F3	+0.18 D2	0.82

Table 37 Standardized parameter estimates for cognitive and metacognitive strategies and reading comprehension test performance at Time 2 (continued)

Variable	Name	Label	Loading	Error	R^2
F6	Retrieval	Retrieval strategies	0.20*F1 +0.20*F2 +0.20*F3 +0.33*F5	+0.18 D3	0.82
F7	RCTP2	RCTP2 strategies	0.36*F4 +0.22*F5 +0.33*F6	+0.22 D4	0.78

Based on Figure 12, it was found that there was only one-way communication between the comprehension, memory, and retrieval strategies. In other words, contrary to initially thought, the relationship was not mutual. First, memory strategies were eliminated because it was discovered through testing and re-testing of the hypothesized SEM model that memory strategies do not affect how much retrieval or comprehending strategies are used. Second, performance on reading comprehension tests was directly impacted by retrieval strategies (R^2=0.14; regression coefficient=0.37; large ES). Third, evaluating strategies significantly impacted

retrieval strategies (regression coefficient = 0.79; large ES; R^2=0.62). As Figure 8 illustrates, this indicates that retrieval strategies are primarily dependent on how well reading comprehension test performance.



Note: F1 = planning strategies, F2 = monitoring strategies, F3 = evaluating strategies,
F4 = Comprehending Strategies, F5 = Memory Strategies, F6 = Retrieval Strategies,
F7 = reading comprehension test performance.

Figure 12 The hypothesized model of the interrelationship among cognitive and metacognitive strategies to reading comprehension test performance Time 2 (Model 7)

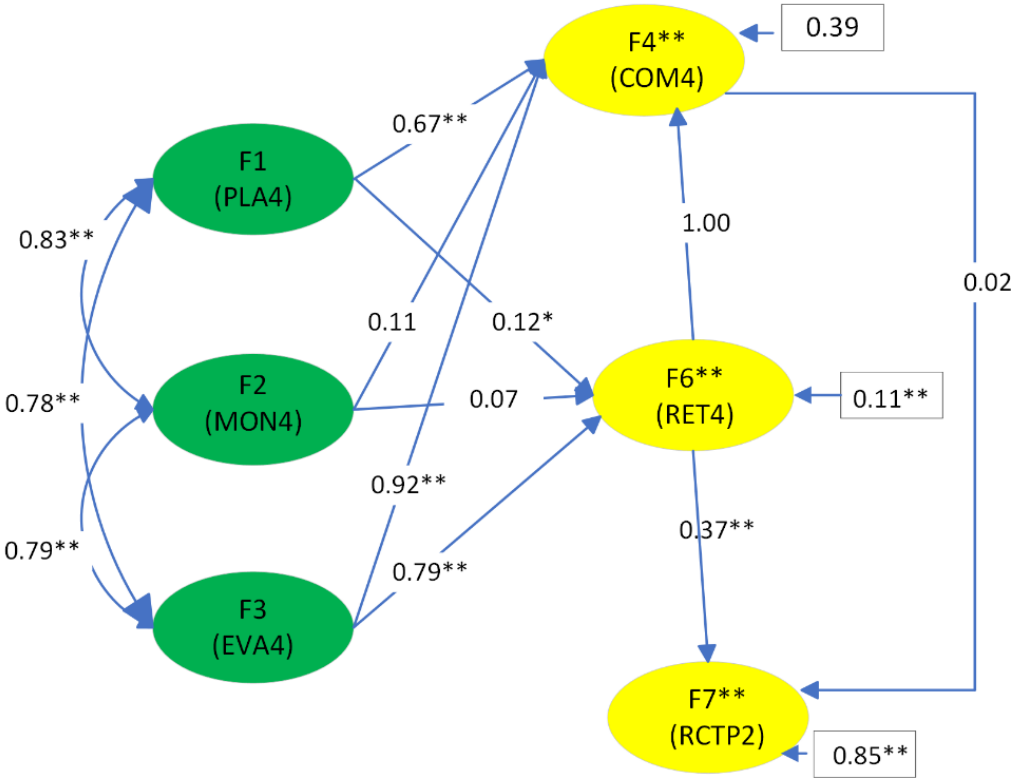


Figure 13 The hypothesized model of the relationships of cognitive and metacognitive strategies in real-time to reading comprehension test performance Time 2 (Model 8)

Figure 12 illustrates that retrieval, memory, and comprehending strategies are all part of cognitive strategies. Specifically, *comprehending strategies* were explained by V11 (look for the main idea in the first sentence; loading fact: 0.81; R^2=0.66), V12 (figure out the main ideas' link; loading factor: 0.81; R^2=0.66), V15 (consider what needs to be done; loading factor: 0.75; R^2=0.56), and V16 (interpret what the author attempted to communicate, with a loading factor: 0.74; R^2=0.55). The correlation coefficients between these observed strategies ranged from 0.55 (V15 and V16) to 0.66 (V11 and V12), according to the computation of correlation coefficients. One might calculate the correlation coefficients between observed variables by multiplying the factor loadings or weights between variable pairs. Comprehending strategies' total common factor variance (h^2) is (0.81 + 0.81 + 0.75 + 0.74)/4 = 0.78. This showed that 78% of the variance in the comprehending strategy factor was described by the four variables. This means that 22% of the overall variance was explained by the unique (residual) factor variance. To summarize, the comprehending strategies include identifying the

main idea in the first sentence, determining the link of the main idea, anticipating the following action, and understanding the author's intended message.

The *retrieval strategies* were accounted for by V25 (use prior knowledge, loading factor: 0.82; R^2=0.67), V26 (aware of relevant information; loading factor: 0.81; R^2=0.66), V27 (use context clues; loading factor: of 0.80 (R^2=0.64), V28 (use the grammar rules, with a loading factor: 0.80; R^2 = 0.64), V29 (know root words, loading factor: 0.79: R^2=0.63), V30 (infer the information; loading factor: 0.82; R^2=0.67) and V31 (comprehend from prior knowledge; loading factor: 0.79: R^2=0.57). The correlation coefficients of these observed variables varied from 0.62 (V29 and V31) to 0.67 (V25 and V30). By multiplying the weights or factor loadings between pairs of variables, one may obtain the correlation coefficients among observed variables of 0.80 (0.82 + 0.81 + 0.80 + 0.80 + 0.79 +0.82 + 0.79)/7) is the overall common factor variance (h^2) of planning strategy. The seven variables accounted for 80% of the retrieval strategy factor variance. This means that 20% of the variance overall was explained by the unique (residual) factor variance. To recap, retrieval strategies include the following: using prior knowledge, being aware of relevant information, using context clues and grammar rules, understanding from prior knowledge, inferring the data, and knowing root words.

Planning strategies were explained by V1(making a plan before starting to read, loading factor: 0.84; R^2=0.70), V2(understand the task's goal; loading factor: 0.78: R^2=0.60), V3 (consider what needs to be done, loading factor: 0.78; R^2=0.61), V4 (know what to do and how to do; loading factor: 0.79; R^2=0.62), V5 (know what to do if the plan did not work well; loading factor: 0.79; R^2=0.62), V7 (test questions to identify purposes; loading factor: 0.74; R^2=0.55) and V9 (highlight the length and arrangement of the text; loading factor: 0.72; R^2=0.52). The correlation coefficients between these observed variables ranged from 0.53 (V7 and V9) to 0.66 (V1 and V7). The total common factor variance (h^2) of planning strategy is (0.84 + 0.78 + 0.78 + 0.79 + 0.79 +0.74 + 0.72)/7 = 0.78. This indicated that the seven variables accounted for 78% of the planning strategy factor variance. In other words, 28% of the overall variance was explained by the variance of the unique (residual) factor variance. In brief, planning strategies, in general, making a plan before starting to read,

understanding the task's goal, considering what needs to be done, knowing what to do and how to do it, using test questions to determine goals, and emphasizing the text's length and organization.

Monitoring strategies were explained by V32 (be aware of the time limitations; loading factor: 0.82; R^2=0.67), V33 (be aware of the amount of reading and tasks; loading factor: 0.82;(R^2=0.67), V34 (be aware of when and where of confusing, loading factor: 0.79; R^2=0.63), V35 (realize when get anxious, tense or uninterested; loading factor: 0.79; R^2=0.63), V36 (know when losing attention; loading factor: 0.77; R^2=0.59), V37 (double-check, or self-reflect; loading factor: 0.76; R^2=0.57), V38 (aware of whether or not comprehend the text; loading factor: 0.78; R^2=0.61), V39 (know to pay more attention; loading factor: 0.79; R^2=0.62), V40 (know when to speed up reading; loading factor: 0.79; R^2=0.62), V41 (manage the time; loading factor: 0.74; R^2=0.55), V42 (correct mistake quickly: loading factor: 0.78; R^2=0.60), V43 (adapt reading speed; loading factor: 0.76; R^2=0.58), V44 (adapt the pace of answering; loading factor: 0.76; R^2=0.58) and V45 (use context clues to enhance reading ability; loading factor: 0.77; R^2=0.60). The correlation coefficients between these observed variables ranged from 0.56 (V37 and V41) to 0.67 (V32 and V33). The total common factor variance (h^2) of monitoring strategy is 0.78 (0.82 + 0.82 + 0.79 + 0.79 + 0.77 +0.76 + 0.78 + 0.79 + 0.79 + 0.74 + 0.78 + 0.76 + 0.76 + 0.77)/14. This showed that the fourteen variables explained 78% of the variance in the monitoring strategy factor variance. This means that 22% of the overall variance was accounted for by the variance of the unique (residual) variables. In conclusion, planning, being aware of time constraints, being aware of the amount of reading and tasks, recognizing when and where might be confusing, knowing when one becomes tense, anxious, or disinterested, recognizing when one is losing attention, double-checking or reflecting on oneself, being aware of whether has understood the text, knowing when to pay closer attention, knowing when to read more quickly, adapting reading speed, and using context clues to improve one's reading ability are all examples of monitoring strategies.

The following explained *evaluating strategies*: V47 (evaluate my performance and progress; loading factor: 0.89; R^2=0.80), V48 (evaluate reading strategies; loading

factor: 0.77; R^2=0.59), V49 (take notes; loading factor: 0.77; R^2=0.59), V50 (restate in own words; loading factor: 0.59; R^2=0.35) and V51 (evaluate the text suit for reading purpose; loading factor: 0.53; R^2=0.28). The correlation coefficients of these observed strategies ranged from 0.34 (V50 and V51) to 0.68 (V47 and V48). By multiplying the weights or factor loadings between pairs of variables, one may attain the correlation coefficients among the observed variables. The strategy's overall common factor variance (h^2) is equal to 0.54 (0.89 + 0.77 + 0.71 + 0.59 + 0.58)/5). These five variables explained 54% of the variance in the evaluating strategy factor variance. As a result, 46% of the variance was explained by the unique (residual) factor variance. To sum up, evaluating strategies includes evaluating one's performance and development, assessing reading strategies, taking notes, restarting in one's own words, and assessing whether the material is worth reading.

Effects of metacognitive strategies on cognitive strategies

The relationship between metacognitive and cognitive strategies is depicted in Figure 13. The planning (F1), monitoring (F2) and evaluating (F3) strategies had differential relationships to comprehending(F4) and retrieval (F6) strategies. The direct effects of metacognitive strategies on cognitive strategies were studied in several other models before the current SEM model. It is intriguing that memory and metacognitive strategies do not interact. The researcher thus examined the link at Time 2 between reading comprehension test performance and cognitive and metacognitive strategies. That being said, not every metacognitive strategy has the same impact on cognitive processes. How specific metacognitive strategies are portrayed with specific cognitive strategies is intriguing.

Initially, it was discovered that the application of retrieval and comprehending strategies was directly impacted by planning strategies. Planning strategies, however, were found to directly influence retrieval strategies through evaluating strategies (regression coefficient: 0.91[0.79+0.12]; R^2 = 0.82; large ES). This link suggests that, instead of understanding the text, evaluating strategies tends to improve text retrieval or information directly. Second, it was discovered that retrieval strategies (regression coefficient: 0.07; R^2=0.004; small ES) and comprehending strategies (regression coefficient: 0.11; R^2=0.01; tiny ES) were directly impacted by monitoring strategies.

This finding is intriguing since it shows that monitoring does not affect the accuracy of information stored during reading and testing. It may not work as intended when accurate monitoring or monitoring strategy activation is combined with contradicting strategies. It might be argued that monitoring has no bearing on some cognitive strategies based on the current results.

Third, it was discovered that evaluating strategies directly impacted retrieval strategies (regression coefficient: 0.79; R^2=0.71; large ES). Based on this discovery, evaluating strategies are essential for success when obtaining information for comprehension. Through retrieval strategies, evaluating strategies were found to have an indirect effect on comprehending strategies (regression coefficient: 0.79[0.79 x (1.00); R^2=0.62; large ES). It is feasible that strategies for judging (evaluating) reading comprehension tests are connected to deliberate actions used to retrieve information. It is feasible to argue that monitoring and evaluating strategies are complementary based on the current findings.

Effects of cognitive strategies on EFL reading test performance

According to the statistical analysis of model fitness, not every cognitive strategy had the same effect on reading comprehension test performance. Figure 13 revealed that memory strategies were not included, suggesting no impact on the reading comprehension test results. Retrieval strategies also directly influenced reading comprehension test performance (regression coefficient: 0.79; R^2=0.62; large ES). Comprehending strategies had a small factor loading (regression coefficient: 0.02; R^2=0.004) on the reading comprehension test. In short, it can be claimed that comprehending strategies by themselves do not affect reading comprehension test performance (Time 2); instead, the simultaneous orchestration of planning, monitoring, evaluating, comprehending, and retrieval strategies contribute to reading achievement.

A number of regression paths from the three cognitive strategies on EFL reading test performance were tested and retested prior to the SEM model in Figures 6 and 8. Nevertheless, it was discovered that not every cognitive strategy had the same impact on EFL reading test performance based on the statistical assessment of model fitness.

The findings highlight and demonstrate the relevance of metacognitive strategy use to cognitive and EFL reading comprehension test performance, which is less explored in the language testing theories and prior empirical studies of test takers' strategy use. The use of metacognitive strategies has a significant indirect effect on reading comprehension test performance, suggesting that metacognitive strategies are an important aspect of strategic competence that affects test performance.

Cognitive strategy use was found to have a direct and positive effect on EFL reading comprehension test performance in the present study. In contrast to metacognitive strategies, cognitive strategies refer to the actual strategies used by test takers to address particular issues that occur during test situations. Metacognitive strategies, which deal with the regulation of higher-order thinking, are often inferred from cognitive activities rather than being explicitly observed during reading tests (Lin et al., 2019; Veenman et al., 2006). The use of metacognitive strategies affects test performance through the use of cognitive strategies. The result lines up with the findings of Purpura (1999) and Phakiti (2008), who found that the use of cognitive strategies was the only factor that directly affected test takers' performance.

The present study also supports the findings of Phakiti (2006) that the positive relationship between the use of cognitive and metacognitive strategies and EFL reading test performance suggests that successful and unsuccessful test takers differed in their use of these strategies (i.e., successful test takers reported higher degrees of cognitive and metacognitive strategy use than unsuccessful test takers). This is because the influence of cognitive and metacognitive strategies on EFL reading test performance was examined through variance and covariance analyses of individual differences data. The degree to which the use of cognitive and metacognitive strategies is associated with the variance in test scores was then reflected in differences in their strategies.

In brief, cross-sectional SEM analyses have provided a number of interesting findings in regard to an interrelationship between cognitive and metacognitive strategy use and reading comprehension test performance. While cross-sectional research is essential, its ability to capture the complex link between cognitive and metacognitive knowledge and language test performance is constrained. Hence, it is crucial to

correlate cross-sectional data from different time periods wherever feasible. Due to the simultaneous data analysis, the assurance that longitudinal analyses explain these unanswerable problems is greater than cross-sectional analyses. Longitudinal SEM modelling offers a minimum of three primary benefits for this validation study: (1) it permits the examination of variable covariation over time; (2) it enables the testing of models, including data collected at multiple time points, thereby enabling bidirectional cause-and-effect testing; and (3) it enables the assessment of the consistency of variables' effects on others over time.

5.3.5 Modelling reading comprehension test performance over time (Model 9)

Model 9 shows the relationship between reading comprehension test performance over time. Figure 14 illustrates the hypothesized Model (Model 9). A path from reading comprehension test performance Time 1 (RCTP1) to reading comprehension test performance Time 2 (RCTP2) (**) indicates the degree of stability of the same construct measured at different times over time.

All factor loadings were statistically significant at the 0.001 level. The reading comprehension test performance at Time 1 (RCTP1) includes Lexical-Grammatical reading ability about grammar (LexGrRA1), Lexical-Grammatical reading ability about vocabulary (LexGrRA2), and Text comprehension ability (TxtCOMP1) and the reading comprehension test performance at Time 2 (RCTP2) includes Lexical-Grammatical reading ability about grammar (LexGrRA3), Lexical-Grammatical reading ability about vocabulary (LexGrRA4), and Text comprehension ability (TxtCOMP2) were observed on both test occasions, which is consistent with the measuring Model described in Models 9. All factor loadings in the model were comparatively high. The total common factor variance of RCTP1 (h^2) is (0.73 + 0.82 + 0.85)/3 = 0.80. This finding indicated that the three variables accounted for 80% of the reading comprehension test performance factor variance. This indicates that the variance of the unique residual factor accounted for 20% of the total variation.

Likewise, the cumulative common factor variance of RCTP2 (h^2) is 0.81% (0.89% + 0.71 + 0.83/3). The three variables thus accounted for 81% of the variance in the reading comprehension test performance factor. This indicates that the variance of the unique residual factor accounted for 19% of the total variation. In summary, the

performance on the reading comprehension test was correlated with the level of proficiency in decoding input text across lexical, syntactic, semantic, and discourse levels.

The differences in RCTP that were deemed comparable to both occasions were as follows: 80% for performance on the reading comprehension test at Time 1 (RCTP1) and 81% for performance on the reading comprehension test at Time 2 (RCTP2), as determined by a regression coefficient of 0.38 (R^2=0.14, small ES). Thus, 14% of the variance in reading comprehension proficiency was shared between the two-time points. The structural model exhibited a greater shared common variance in reading comprehension test performance than the measurement model (see Models 3 and 4). It is essential to mention that the percentages represent the proportion of the theoretical construct that can be explained by the residual set's shared common variance. It appears that reading comprehension is consistent over an extended period of time.

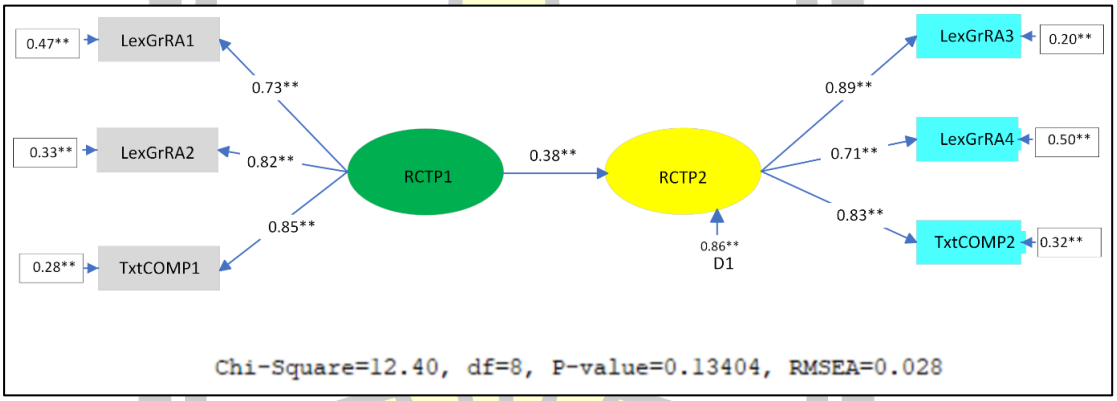


Figure 14 The hypothesized model of the relationship of reading comprehension test performance over time (Model 9)

5.3.6 Modelling cognitive and metacognitive strategy use and reading comprehension test performance over time (Model 10)

To model the relationship between trait and state strategy use in reading comprehension test performance over time, as shown in Model 10, Models 1 and 2 were combined by adding regression paths from one occasion to another. Figure 10 illustrates the hypothesized model (Model 10). A path from reading comprehension test performance Time 1 (RCTP1) to reading comprehension test performance Time 2

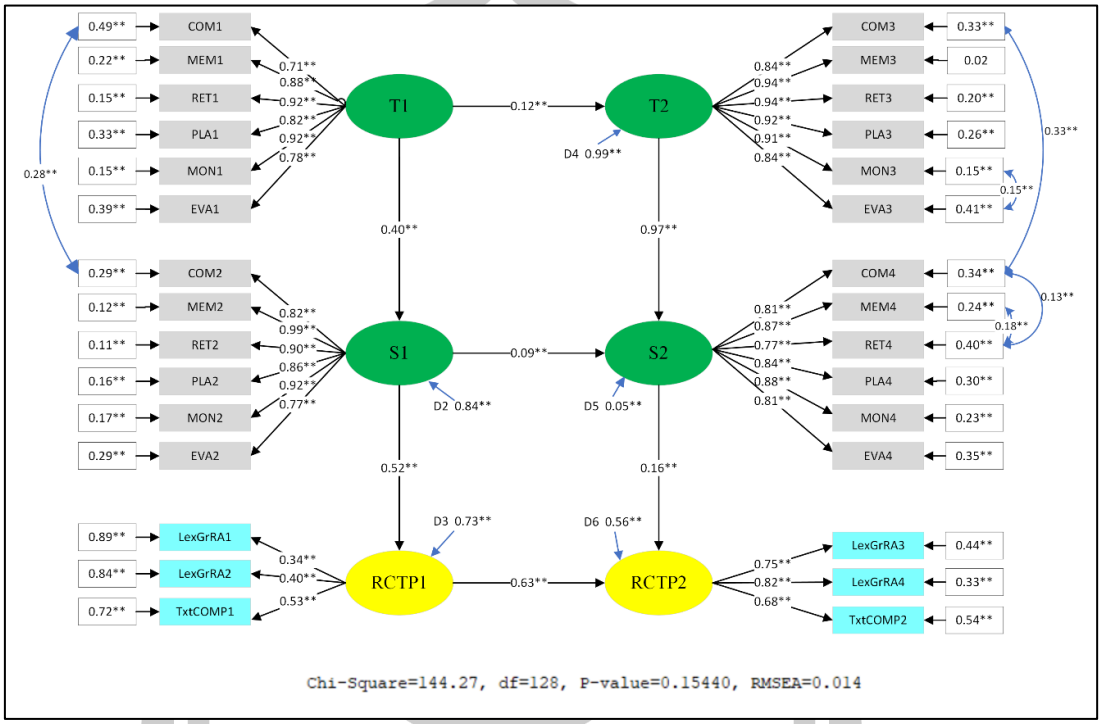
(RCTP2) (→► **) indicates the degree of stability of the same construct measured at different times over time.

The use of trait strategies, including planning, monitoring, evaluating, comprehending, memory and retrieval strategies, was observed on both test occasions, which is consistent with the measuring model described in Models 1 and 2. Regarding all strategies, factor loadings in the Model were comparatively high. The differences in trait strategy use that were considered comparable to both occasions were 83.8% for trait strategy use at Time 1 (T1) and 87.7% for trait strategy use at Time 2 (T2) with the regression coefficient of 0.12 (R^2 = 0.014, small ES). The two time points shared 1.44% of the variance in trait strategy use. The shared common variance in trait strategy use T2 in the structural model was higher than in the measurement model, as presented in Models 1 and 2. It should be noted that the percentages indicate how much of the theoretical construct is accounted for by the shared common variance in the set of regression coefficients. These findings suggest that language learning strategy use or trait strategy use is stable over time.

It was also discovered that each of these trait strategies was highly interrelated. The correlations between these generally perceived strategies at T1 vary, with trait comprehending and trait evaluating strategies having a large effect size of 0.56 (R^2=0.32), while trait retrieval and trait monitoring strategies have a large effect size of 0.84 (R^2=0.72). At Time 2, the relationships between these generally perceived strategies vary, with trait comprehending and trait evaluating strategies having a large effect size of 0.77 (R^2=0.60) and trait retrieval and trait monitoring strategies having a large effect size of 0.88 (R^2 = 0.88). Based on the factor loadings and correlations between the two observed variables, it can be drawn that the knowledge required to perform the reading test using strategies primarily pertains to (1) monitoring to reprocess or retrieve information and (2) assessing the planning to attain the goals.

As seen by Model 10, the factor loadings for each strategy were relatively high. The shared common variances of state strategy use on both occasions were 89.8% for the state strategy use at Time 1 (S1) and 83.07% for state strategy use at Time 2 (S2). The regression coefficient between the use of state strategy at S1 and S2 was 0.09 (R^2=0.008), indicating a small effect size. The regression coefficient indicates that a

9% prediction can be made regarding the degree to which state strategy is used in one context in another.



Note: T = Trait, S = State, 1 = Time 1, 2 = Time 2, RCTP = reading comprehension test performance

Figure 15 The hypothesized model of the relationship of trait and state strategy use on reading comprehension test performance over time (Model 10)

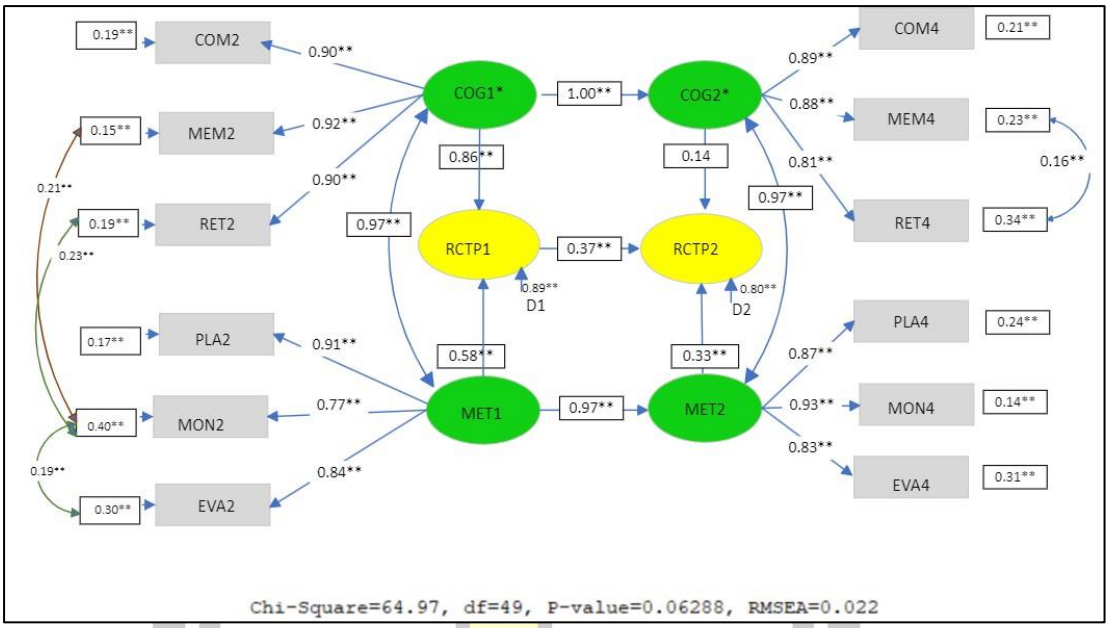
A close correlation was observed between all of these state strategies. Relationships between these generally perceived strategies at Time 1 vary from 0.63 (R^2 = 0.40, large ES) for state comprehending and evaluating strategies to 0.91 (R^2 = 0.83, large ES) for state memory and state monitoring strategies. At Time 2, the relationships between these strategies that are generally seen vary in degrees. State retrieval and evaluative strategies have a large effect size of 0.62 (R^2 = 0.38), whereas state memory and state monitoring strategies have a large effect size of 0.76 (R^2 = 0.58). According to the factor loadings and correlation coefficients between the two observed variables, it can be deduced that the level of knowledge about employing strategies to complete the reading test primarily concerns (1) planning the goals to achieve the reading comprehension test and retrieve information and (2) retrieving the information from the memory storage, and (3) monitoring an individual's comprehension of the material during the test.

5.3.7 Modelling the relationship between cognitive and metacognitive strategy use and reading comprehension test performance over time (Model 11)

To model the relationship between cognitive and metacognitive strategy use in real-time situations on reading comprehension test performance over time, as shown in Model 11, Models 3 and 4 were combined by adding regression paths from one occasion to another. Figure 10 illustrates the hypothesized model (Model 11). A path of cognitive and metacognitive strategies in real-time situations from reading comprehension test performance Time 1 (RCTP1) to reading comprehension test performance Time 2 (RCTP2) (→**) indicates the degree of stability of the same construct measured at different times over time.

Model 11 illustrates the stability of the relationship between cognitive and metacognitive strategy use and reading comprehension test performance over time. The results showed that in both times of tests, cognitive strategy use included comprehending, memory, and retrieval strategies. All the factor loading was high for all strategies use categories. The shared common variance of cognitive strategy use on both occasions was 84% in cognitive strategy use at Time 1 and 82% in cognitive strategy use at Time 2. The shared common variance in cognitive strategy use at Time 1 in the structural model was lower than in the measurement model at Time 2. These findings imply that cognitive strategy use is unstable over time. However, the regression coefficient from cognitive strategy use at Time 1 (COG1) to cognitive strategy use at Time 2 (COG2) was 0.92 (R^2=0.85, large ES), indicating that the shared variance between the cognitive strategy use at both times was 85%.

All these cognitive strategies were found to be highly interrelated. At Time 1, the relationships among these strategies range from 0.64 (R^2=0.41, large ES) for comprehending and retrieval strategies to 0.83 (R2=0.69, large ES) for memory and retrieval strategies. At Time 2, the relationships among these strategies range from 0.61 (R^2=0.38, large ES) for comprehending and retrieval strategies to 0.71 (R^2=0.51, large ES) for memory and retrieval strategies. Based on the factor loadings and correlations from the two observed variables, it may be inferred that the knowledge about cognitive strategy to do the test is more about retrieving the information from the memory storage and comprehending it while taking the test.



Note: COG = Cognitive strategies, MET = Metacognitive strategies, 1 = Time 1, 2 = Time 2, RCTP = reading comprehension test performance

Figure 16 The hypothesized model of the relationship of cognitive and metacognitive strategy use in real-time to reading comprehension test performance over time (Model 11)

It was also found that at both times of the tests in Model 11, metacognitive strategy use was composed of planning, monitoring, and evaluating strategies. All the factor loading was very high for all strategies use categories. The shared common variance of metacognitive strategy use on both occasions was 91% in metacognitive strategy use at Time 1 and 86% in cognitive strategy use at Time 2. The shared common variance in cognitive strategy use at Time 1 in the structural model was higher than in the measurement model at Time 2. These findings imply that cognitive strategy use is unstable over time. Nonetheless, the regression coefficient from metacognitive strategy use at Time 1 (MET1) to metacognitive strategy use at Time 2 (MET2) was 0.97 (R^2=0.94, large ES), indicating that the shared variance between the metacognitive strategy use at both times was 94%. Notably, the shared variance between the two times was large, but implementing metacognitive strategies was unstable.

All these metacognitive strategies were found to be highly interrelated. At Time 1, the relationships among these strategies range from 0.64 (R^2=0.42, large ES) for

monitoring and evaluating strategies to 0.76 (R^2=0.58, large ES) for planning and evaluating strategies. At Time 2, the relationships among these strategies range from 0.72 (R^2=0.52, medium ES) for planning and evaluating strategies to 0.80 (R^2=0.65, large ES) for planning and monitoring strategies. The factor loadings and correlations from the two observed variables indicated that the knowledge about the metacognitive strategy to do the test is more about monitoring to achieve the planning goals and evaluating the plan while taking the test.

The effects of cognitive and metacognitive strategy use on EFL reading comprehension test performance ranged from 0.58 to 0.86 at Time 1 and from .14 to 0.33 at Time 2, as shown in Model 11. These findings support prior L2 English research that found strategy use to be a minor predictor of test-takers' language test performance (Lin et al., 2019; Phakiti, 2008; Song, 2005; Zhang et al., 2014). Moreover, the current results support Bachman and Palmer's (2010) model of language use, which grasps that strategy use is one of the individual characteristics influencing test performance; other individual characteristics, such as topical knowledge, personal attributes, and language knowledge, also affect test performance. Language knowledge is the main individual characteristic that contributes to test performance. Purpura (1999) argued that test takers' performance on language tests predominantly depends on their own language knowledge.

Models 10 and 11 allow the researcher to understand the nature of language performance on reading comprehension consistency. Based on Chapelle (1998), interactionalists need to obtain evidence of language performance consistency because there should be some proportions of relevant variance of language test performance shared with various tests. According to Model 9, the regression coefficient between the two reading comprehension tests was 0.38 (R^2 = 0.14), indicating that the shared variance between the two reading comprehension tests was 14%. This finding is essential for test construct validity. The test-takers who performed well the first time were also likely to achieve well in the second test (14% predictive success). Second, since the time to do the tests was about two months, there were some other variances, such as two different contexts that might not be interpreted as if they had been affected by the same set of factors (Tarone, 1998).

In summary, the use of trait strategy is more stable than the use of state strategy. The low stability of state strategy use found in this study might be related to the context of the present study. This context was directly relevant to a formal classroom environment where instruction of EFL reading was expected to improve reading comprehension skills. Perhaps the instruction impacted the state strategy use reports changes at Time 2**.**

5.4 Chapter Summary

This chapter has reported and discussed the results of an empirical investigation of the relationships of trait and state, cognitive and metacognitive strategy use to reading comprehension test performance over time using SEM. It has been found that with three months, similar to trait and state strategy use, the relationships between cognitive and metacognitive strategy use and reading comprehension test performance are highly complex and subtle. Given the nature of cognitive and metacognitive strategy constructs and several possible associations among strategies within this operational setting, the relationships of cognitive and metacognitive strategy application to reading comprehension test performance could have been far more complicated than what has been found. The next chapter will be devoted to the report detailing the qualitative discoveries derived from the interview data.

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CHAPTER VI
QUALITATIVE RESULTS

This chapter presents the findings of the qualitative study. Concerning the results of the primary investigation and responses to the research inquiries, the interview data constitute the sole qualitative source in this investigation. Before providing a summary, this chapter intends to provide a detailed description of each emergent issue. In this study, qualitative research serves to corroborate the results obtained from the quantitative data while offering novel perspectives that were not penetrated by the quantitative findings.

6.1 Taxonomy of strategy use in reading comprehension test performance

This section aims to provide deeper insights into the nature of strategy use of Thai high school learners. Here, the focus is the qualitative description and analysis of 12 participants or cases while performing the reading comprehension tests. The participants' reading comprehension test performance is used to categorize them into high, medium, and low reading proficiency learners. The high proficient (H) learners' reading comprehension test performance was at 70% or above, while the low (L) proficient learners' performance was at 40% or lower. The medium (M) proficient learners' reading comprehension test performance was between 41% and 69%. The underlying assumption for these three cohorts of participants is that learners with higher proficiency levels tend to employ a greater variety of strategies than learners with low proficiency. According to second language acquisition (SLA) theory, individual differences, including gender, play a role in second language (L2) acquisition and academic achievement. In this regard, to avoid prejudice and gender differences, only female participants were selected for the qualitative interview (Sukying, 2021). Other additional information is provided in Chapter 3.

6.1.1 Thematic analysis of strategy use

Strategy application in information processing is linked to strategic competency or metacognition. Metacognitive awareness (the management of cognition) and critical self-regulation (the process of reflecting on one's own thoughts) are attributes that are common to the ideas of strategic competence and metacognition that overlap. As a result of actively monitoring their thinking and performance, individuals employ and

regulate additional cognitive processes in order to attain cognitive objectives. According to the information processing theory, strategic processing is distinguished from automatic processing by the degree of awareness involved in information processing. When individuals engage in L2 use, such as reading comprehension, their reading processes might vary from automatic to conscious (Alderson, 2000). Automatic recognition of word meanings, grammatical structures, and pieces of speech are all components of lower-level processing.

In contrast, when reading difficulties develop, strategic procedures primarily facilitate comprehension (e.g., experiencing unfamiliar words or syntactic structures). These procedures assist readers in increasing the probability of attaining reading proficiency. Phakiti (2003, 2006, 2007) posits that the behavior of information processing events is influenced by the control processing component, which is synonymous with the nature of strategies. Thus, strategic processing or strategy use refers to the purposeful, intentional, and conscious thought processes that target language users engage. The qualitative data were analyzed following Phakiti's (2007) cognitive and metacognitive techniques taxonomy. Cognitive techniques include retrieval, memory, and comprehension, whereas metacognitive strategies comprise planning, monitoring, and evaluation. In a more precise manner, the strategies for comprehension consist of identifying the central idea, summarizing, translating, deducing the meaning of unfamiliar words by contextual cues, and drawing conclusions from the information at hand. Memory strategies incorporate essential elements such as boldface, italics, and underlining of crucial topics. All retrieval procedures include utilizing prior (background) knowledge, comparing newly acquired information within the text, applying grammatical rules, using word-part knowledge, and meaning recall. Planning strategies encompass a range of metacognitive approaches, including but not limited to the following: establishing and maintaining reading goals, identifying the tasks that must be completed, planning the steps that must be taken before reading, reviewing reading materials in advance, and determining the appropriate time to engage in careful reading. Monitoring strategies include assessing comprehension, regulating concentration while reading, identifying instances of distraction, and reassessing comprehension when uncertain material is encountered. Evaluating strategies include assessing text difficulty levels, self-questioning during or after reading, accuracy

evaluation, comprehension verification, content evaluation, and critical assessment of the quality of the text material.

6.1.2 Taxonomy of metacognitive and cognitive strategy use in reading comprehension test performance

With reference to reading comprehension test performance results, the strategy use varied according to participants' reading comprehension ability. Therefore, participants with higher proficiency levels tend to deploy a larger number of strategies and greater varieties than students with low proficiency. These findings align with the literature that high proficient learners execute a greater variety of strategies than those with low proficiency (Sukying, 2021).

Comprehending strategies

Table 34 lists the key aspects of comprehending strategies Thai high school participants reported among three reading proficiency abilities. The results showed that Thai high school participants with different reading abilities used similar aspects of comprehending strategies. However, the analysis of the results indicated that high proficient participants tended to use comprehending strategies more frequently than low-proficient readers.

Table 38 Comprehending strategies reported by participants with different proficiency readers

Participants	Key aspects	Sentence samples
L1	find main ideas and details, use context clues, summarise	I would **find the topic sentences** of the passage, which usually were **at the beginning of the passage**.
L2	find main ideas, guess the meaning, use context clue	If the question were true or false, I would **use the context clues** from the text.
L3	summarise, guess the meaning, translate	I then went back to them in an attempt to **comprehend** the question and find the correct answer.
L4	translate, guess the meaning, comprehend	I usually **translated** the passage into Thai to understand and comprehend the passage.
M1	make inferences, main ideas, infer the meaning, identify the author's attitudes	I **infer** the passage's meaning and the writer's aim from contrasting words or phrases.
M2	connect important ideas in the text, find details, guess the meaning	I would draw a circle on the important word and try to **use the word to connect with another sentence**.

Table 39 Comprehending strategies reported by participants with different proficiency readers (Continued)

Participants	Key aspects	Sentence samples
M3	translate, infer the meaning, guess the meaning, identify the author's attitudes	I **translated the words** closely related to the reading test items as I read. I used the general idea of the reading input to help me **guess the meaning** of the words I did not understand.
M4	predict translate summarise	I occasionally **predict the definition** rather than using the word's root to determine its meaning I **translated keywords** into the Thai language while I was reading. Sometimes, I read the item about 2-3 rounds to understand the question and then **comprehend** the passage in each paragraph.
H1	find main ideas, use context clues, summarise	I would **find the main idea** of each passage. I would use the **context clues** to understand the sentence or passage.
H2	find main ideas and details, understand the passage, use references, guess the meaning	I would **read the passage first** to **find the main idea**, the thesis statement and details about the years or figures in the passage. I would look at the words that **refer to** or reference the passage.
H3	connect important ideas in the text, summarise, find details	If the passage were long, I would read quickly or scan the passage first, then look at the questions and **what they are about.** After that, I would **go to the point or that area of the question** to seek the answer. For some words, I **understood the meaning and the area of the text** or the topic.
H4	use context clues, summarise	I **applied the context cues to make me comprehend** the information when I arrived at a tricky word.

Noted: L = Low proficiency level; M = Medium proficiency level; H = High proficiency level

Memory strategies

Table 35 lists Thai high school students' essential memory strategies concerning three reading comprehension abilities. According to the findings, participants from Thai high schools with varying degrees of reading proficiency employed comparable elements of memory strategies. Nevertheless, the findings analysis revealed that individuals with high proficiency demonstrated a greater propensity to use memory strategies than those with low reading proficiency.

Table 40 Memory strategies used by participants with different proficiency levels

Participants	Key aspects	Sentence samples
L1	use bold or italic letters, reread	It helped me a lot if the passage had **bold or italic letters**.
L2	use bold letters, reread, remember	I used **bold letters** in the passage or question to help me find the answer quickly.
L3	use figures, recognize, use the first language to translate	The **figures** helped me understand the passage, making it easy to do the test.
L4	use bold letters, pictures and tables; use the first language to translate	I **used bolded words** in the paragraph or question to speed up my search for an answer. I thought the best part I could do was the part which had a **picture and tabl**e.
M1	remember	I would **check or mark** the item that I thought would be correct.
M2	use typographical features	While reading the text, I would **draw a circle** on the vital word and try to use the word to **connect** with another sentence.
M3	use figures and pictures, reread	The **table with numbers** was quite easy to understand. If there was **a picture** in the passage,…
M4	recognize, using the first language to translate	To respond to the question, I **used synonyms** for the concepts.
H1	reread the text to understand, use typographical features	I **practised reading long passages** in my free time, which helped me quickly understand the long passages in the test. I would **highlight or circle** the topic or keywords in the text.
H2	use figures; remember	…the thesis statement and details about **the years or figures** in the passage.
H3	use typographical features, use figures and bold letters; reread	If I skipped the problematic item, I would **mark** it or **use a symbol** I was unsure about…
H4	use bold letters, reread, remember	… the **bold letters made it easier** for me to get the answer fast …. In the lengthy text, I could **notice the bold and italicized letters useful** for me in reading.

Noted: L = Low proficiency level; M = Medium proficiency level; H = High proficiency level

Retrieval strategies

Table 36 provides an overview of the essential components that comprise retrieval strategies. The results indicated that Thai high school participants, whose reading proficiency varied, utilized similar components of retrieval processes. Upon analysing the data, it was ascertained that those with higher levels of reading proficiency employed retrieval strategies more frequently than those with lower levels of ability.

It was also found that higher proficient readers used a greater variety of retrieval strategies. This may indicate that Thai EFL students with higher reading ability tend to execute a broader range of cognitive strategies more frequently than less proficient readers.

Table 41 Retrieval strategies used by participants with different proficiency levels

Participants	Key aspects	Sentence samples
L1	use known words	I would **choose the preferred** alternative if I didn't know the answer.
L2	use known words	I would choose the alternative that **I got used to** if I didn't know the answer.
L3	use known words	If unsure about the answer, I would go with **the one I was familiar** with.
L4	use known words	I **used the words I understood** to guess the meaning of the words I did not understand.
M1	use prefixes and suffixes, use prior knowledge/experience, use antonyms	I would examine the **prefixes and suffixes** to help me understand the problematic word. I used the **words I used to remember from my knowledge** after trying to **memorize** them.
M2	use root word, compare text	I tried to guess the meaning of the problematic word **from the root** of the word. I would ask myself what the text was **relevant** to my life.
M3	use grammar rules, memorize, use antonyms	For some words, I could guess the meaning from the **form of the word.** I felt I could understand the text by reading and **understanding word by word**, but I had to read it twice or thrice.
M4	use root words, use antonyms, use prior knowledge	Some passages, **drug labels**, I **got used to reading in my daily life** so I could understand it well.
H1	use prior knowledge/experience, use root, prefix and suffix words	I would use **the root and prefix-suffix** to help me understand the phrase.
H2	use prior knowledge/experience, use root words, use synonyms	I used **the root of the word** to understand the meaning. I used **synonyms** for the words to answer the question.
H3	use prior knowledge, use grammar rules	I understood the passage or test better because of **my prior knowledge and experience**, such as the science subject.
H4	memorize, use prior knowledge, use grammar rules	Most of the **words in the test I have learned before**, or I **knew the meaning** of the word, such as the form of the verb in the past …

Table 42 Retrieval strategies used by participants with different proficiency levels (Continued)

Participants	Key aspects	Sentence samples
		Regarding the grammatical part, I tried to **think about the word type**. I meant that part of speech, …

Noted: L = Low proficiency level; M = Medium proficiency level: H = High proficiency level

Planning strategies

Of the three reading proficiency skills, Table 17 displays the most essential parts of the planning strategies that Thai high school students reported using. The data showed that pupils in Thai high schools with varying reading comprehension abilities utilized planning strategies with similar characteristics. The analysis of the results, on the other hand, revealed that participants with high proficiency levels tended to employ planning techniques more frequently than those with low proficiency levels.

Table 43 Planing strategies used by participants with different proficiency levels

Participants	key aspects	Sentence samples
L1	overview texts, plan steps	I would **scan every page** of the test… I would **start doing** the test from **the first question** respectively. I would **do this part (long passage) in the last part** of the test.
L2	plan steps, overview texts	I would choose to **do the short passage and easy questions first…**I would do the long passage later. I **scanned or looked at the test quickly** and answered.
L3	plan steps	I would then **do the simple tasks** and **leave the challenging** ones.
L4	plan steps, identify reading task expectations	I would **start with a quick read and simple questions**. Later, I would attempt the complex passage.
M1	overview texts, plan steps	I would **open** the test cover and read **from the first to the last page**.
M2	overview texts read carefully	I would **read carefully to look for more detail** to answer the question…
M3	overview texts, plan steps	I would **look at all items first**. Then, I would **do the easy items** and **skip the problematic items** or the long passage.
M4	identify reading task expectations, setting reading purposes or goals	I **spent the time to focus harder on the test items when I had trouble** understanding.

Table 44 Planing strategies used by participants with different proficiency levels (Continued)

Participants	key aspects	Sentence samples
H1	plan steps, read carefully, identify reading task expectations	I **read the question first** before finding the answers. I would **read each sentence carefully.**
H2	read carefully, plan steps, identify reading task expectations, overview texts	…and **read carefully** to get the main point or the scope of the passage or the story. I would **spend the time to look at** the two or three sentences first.
H3	setting reading purposes or goals, overview text, planning steps	I **reread the text** for more details to **answer the problematic or critical questions.** If I **skipped the problematic item**, I would mark it or use a symbol I was unsure about. **Then, I would return to it** and spend more time doing the test…
H4	identify reading task expectations, set reading purposes or goals, plan steps	I **had a goal in mind** as I read.

Noted: L = Low proficiency level; M = Medium proficiency level; H = High proficiency level

Monitoring strategies

Table 38 provides an overview of the key aspects of monitoring strategies. Participants from Thai high schools reported having one of three levels of reading proficiency on their assessments. A number of characteristics of monitoring strategies were found to be similar among Thai high school students despite their reading abilities being different. Based on the analysis of the results, it was determined that participants with high levels of proficiency in reading were more likely to employ monitoring tactics than those with low levels of proficiency.

Table 45 Monitoring strategies used by participants with different proficiency levels

Participants	Key aspects	Sentence samples
L1	know the time limit, reread and recheck	If I had the **time left**, I would go back to **reread and recheck** the answer.
L2	know the time limit, reread and recheck	If I had **the time left**, I would **reread and recheck** the items I guessed or was unsure whether the answer was correct.
L3	double-checking, knowing the time limit	I would **double-check** the questions I guessed or when I wasn't sure whether the answer was correct **if I had more time**.
L4	know the time limit	I would not have **enough time** for the long passage, so I did not spend the with the long passage.

Table 46 Monitoring strategies used by participants with different proficiency levels (Continued)

Participants	Key aspects	Sentence samples
M1	know the time limit, control the concentration	If unsure, I would skip and return that item if I had **enough time.**
M2	know the time limit	I didn't want to **spend more time. I** would guess the meaning immediately to save time.
M3	check comprehension control the concentration double-checking	Afterwards, I **returned** to them to understand the question and seek the answer. I **focused harder** on the test items when I had trouble understanding them.
M4	know the time limit, control the concentration	I **tried to get back on track when I lost concentration** on the long passage.
H1	know the time limit, double-check, reread and recheck	If there were still time, I would **go over and double-check** the items in question.
H2	know the time limit, control the concentration	I **got angry** when I couldn't comprehend the test items and had **to concentrate more** on them.
H3	know the time limit, double-check, recheck	I usually had **the time left to recheck** the answer before submitting it. I **changed the answer** about 4-5 items for the second time of **rechecking.**
H4	reread, know the time limit, control the concentration	Usually, I had **enough time to review my response** before sending it in. I **got upset whenever I saw unknown** grammar or which one I could not remember while reading on the test..I **tried to get back on track** when I **lost concentration**…

Noted: L = Low proficiency level; M = Medium proficiency level; H = High proficiency level

Evaluating strategies

Table 39 provides a list of the essential aspects of evaluating strategies. Participants from Thai high schools reported having one of three levels of reading proficiency on their assessments. Based on the findings, it was found that participants from Thai high schools with varying levels of reading ability utilized similar parts of evaluation schemes. The data analysis revealed that individuals with high levels of proficiency in reading were more likely to employ evaluation procedures than those with low levels of proficiency in reading.

Table 47 Evaluating strategies used by participants with different proficiency levels

Participants	Key aspects	Sentence samples
L1		***-No strategy-***
L2	assess levels of text difficulty	When **I saw the difficult word**, I used the context clues to help me understand the passage.
L3	assess levels of text difficulty, evaluate the accuracy, self-questioning	After reading the test, I **thought** about how I read and what I might **do differently with other** friends. As I read, I **compared** what I understood with what I knew about **the topic.**
L4	evaluate the accuracy and the content	I felt I **was not doing well during the reading test.** I thought **the best part I could do** was the part which had a picture and table.
M1	assess levels of text difficulty	…and then **select** the item I could **find the answer quickly**…
M2	self-questioning	If I **did not understand the text**, I would **ask myself** what the text was relevant to my life.
M3	evaluate the accuracy of self-questioning	While doing the reading test, I would like to know if my friend could do this part or not (**compared with other test takers**, I think **I did well** on a reading test.
M4	evaluate the accuracy evaluate the accuracy and content	I thought I spent too much time at this point, but **I believed I could get the score** from this question. As I read, I **quickly adjusted** my interpretation if I realized it was incorrect.
H1	evaluate the content, assess levels of text difficulty, self-questioning	I **would like to know the scores** of the different parts, which I thought was **quite difficult for me**.
H2	assess levels of text difficulty, checking her comprehension of the text	I got angry when I **couldn't comprehend the** test items
H3	assess levels of text difficulty, evaluate the accuracy, checking her comprehension of the text, self-questioning	I found that the grammatical part is **difficult** for me. I thought I could **achieve good test scores**.
H4	assess levels of text difficulty, self-questioning	If **the passage were complicated**, I would scan or skim it before considering the questions. I **wondered** whether the other students were doing **better than I** was…

Noted: L = Low proficiency level; M = Medium proficiency level; H = High proficiency level

Overall, Thai high school students with varying degrees of reading skills were seen to employ various strategies, some of which were comparable to others. In particular, individuals who are stronger readers compared to their counterparts who are less proficient utilize a more extensive variety of reading procedures. Individual reading

strategies were also less prevalent among readers with lower proficiency levels. The results, as mentioned earlier, indicate that their level of linguistic ability influences the reading comprehension achievement of Thai high school learners.

6.2 Summary of the chapter

The qualitative data suggest that cognitive and metacognitive processes were intricately linked. The participants' metacognitive monitoring of the efficacy of their plans and the juncture at which to modify them may require them to change their strategies as they complete the tasks. They were required to maintain a record of their previous actions, current progress, and upcoming tasks until the assessment was complete. The higher proficiency levels appeared to be aware of the most effective planning, monitoring, and cognitive processes for completing the reading comprehension test tasks. Thus, students with varying degrees of proficiency, particularly those with greater proficiency, apply a greater variety and frequency of strategies.

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APPENDIX

Appendix A: EFL Reading Comprehension Test

Time allowed: 60 minutes

Test Scores: 60 Marks

General Directions:

1. Write your name, student number, and room on the answer sheet before you start doing the test.
2. Read all directions carefully and make sure that you understand them. Ask the proctor(s) for clarification.
3. There are two parts to this section of the test: (1) Gap-filling (20 Marks) and multiple-choice (40 Marks).
4. There are 18 pages in this test, including the cover test.
5. Answer all the questions choosing a, b, c, or d. There is only ONE correct answer for each question. Therefore, do not select more than ONE answer for each question because you will not get a mark on that question. Answer them on your **answer sheet**. Put a cross (X) on the correct answer. If you have made any changes, make sure that you have chosen only ONE answer for each question.
6. Before you return the test and answer sheet to the proctor(s), please answer the questionnaire regarding your thinking during the test.
7. If you are cheating in the examination, you will receive "0" marks in this subject.

Section 1: Gap-filling **Questions 1-20**

Section 2: Multiple-choice **Questions 21-60**

Remember to answer all the questions. If you have trouble with a question, skip it and return to it later.

Section 1: Gap-filling

This part tests your ability to scan and skim texts and complete information.

Directions: Read the text follow. A word or phrase is missing in some of the sentences. Choose the best answer to complete the text.

Questions 1-5 refer to the following article.

In today's world of complex computer games, the system requirements for ___1___ these games are quite stringent. A ____2____ requirement of almost all high tech computer games is a decent graphics card.

Because most games nowadays are developed in 3-D, as opposed to games a decade ago, which were nearly always 2-D, an excellent graphics card is required to enjoy these games to their full __3___. That is why high perfprmance is so important. Computer gamers ____4___ want to have the best-performing computer possible to run these new advanced games.

What this translate into is a need to have the best graphics card, because the __5___ graphics cards aren't cheap (2,500-4,000 THB), computer gamers are always willing to put in extra work.

1. a. run b. runs
   c. ran d. running

2. a. major b. bastion
   c. contraption d. important

3. a. picture b. potential
   c. perform d. product

4. a. play b. always
   c. joy stick d. sanguinely

5. a. late b. later
   c. latest d. lateness

Questions 6-10 refer to the following letter.

Respected Mr. Smith,

I, Nathan Frank, would like to apologize on behalf of our organization, Shark Fisheries for ___6____ to deliver the oder placed by your organization.

There was an accident in making arrangements ____7___your goods; as a result, we could not deliver the order.

You had placed an order for one thousand fishes. Our fishermen had managed to ___8___ the quantity of fish to meet your order. But, while returning, a small misfortune happened. There was a thunderstorm and heavily rainfall. As a result the fish rotted and we counld not manage to deliver your order. I have never been ___9____. ____10___,Nathan Frank

6. a. prevailing b. preventing
   c. tailing d. failing

7. a. for b. on
   c. at d. with

8. a. catch b. wrap
   c. dry d. fishing

9. a. sorrier b. more sorry
   c. sorriest d. most sorry

10. a. Thanks b. your faithfully
    c. Sincerely d. good luck

Questions 11-15 refer to the following article.

The Importance of Sleep.

Sleep is very important for the brain. While we are asleep, the brain repairs itself. It also stores information that it has learned during the day. If we do not get enough sleep, the brain cannot do these things. We become tired and ___11___ Some people find sleep difficult. What can we do ? It is important ____12___

However, there are other things we can do to help us get __13___ First, the bed should be comfortable, with a good mattress and pillows. The bedroom should be dark and quiet, so that we ___14___ by light or noise. We should also have the same routine every evening before we go to bed, for example, read a book, or listen to music. Finally, we should try to go to bed at the same time every night. ____15____ ,we will start to sleep better and feel more active the next day.

11. a. likely to ill easily
b. like to get easily ill
c. like to be ill easily
d. likely to get ill easily

12. a. to get relax
b. in relaxation
c. to be relaxed
d. for being relaxation

13. a. a good night sleep
b. a good nights' sleep
c. a good night sleeping
d. a good night's sleep

14. a. are not disturbed
b. do not disturbed
c. are not disturb
d. do not disturb

15. a. Even though
b. In this way
c. In addition to
d. Provided that

Questions 16-20 refer to the following article.

Drones

Drones use rotors for propulsion and control. You can think of a rotor as a fan, ___16____ they work pretty much the same. Spinning blades push air down. Of course, all forces come in pairs. The rotor pushes down ___17__, the air pushes up on the rotor. This is the ___18___ behind lift, which comes down to controlling the upward and downward force. ____19___ the rotors spin, the greater they lift, and vice-versa. Small drones like mine are easy to fly—a skilled pilot can hover and fly in just about any direction, which ____20___ them great for recording video.

16. a. to b. like
c. from d. because

17. a. at the air b. to the wind
c. on the air d. at the wind

18. a. base idea b. basic idea
c. basical idea d. basically idea

19. a. Fast b. Faster
c. Fastest d. The faster

20. a. makes b. made
c. making d. make

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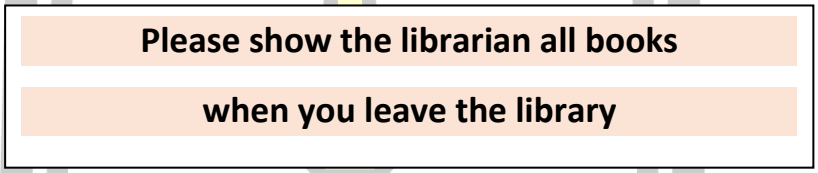
Section 2: Multiple-choice

This part tests your ability to quickly scan and skim texts to comprehend English texts for topics, main ideas, and inferences.

Directions: In this section, you will read the selection of passages, such as magazines and newspapers, articles, letters, and advertisements. Several questions follow each text. Choose the best answer for each question.

Question 21 refer to the following sign.



21. According to this sign, what sentence is TRUE?

a. Make sure you take all your books with you.

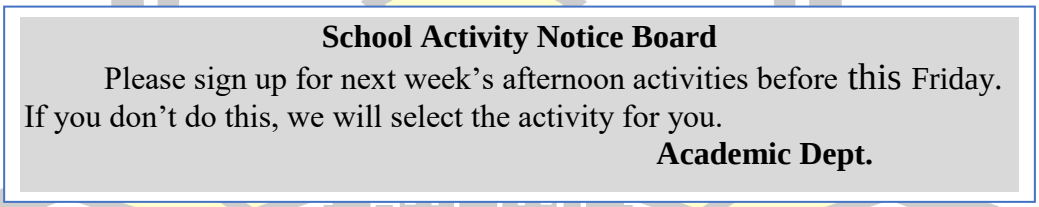
b. Return your books before you leave the library.

c. Show your ID card to the librarian before you go.

d. The librarian needs to see your books before you go.

Questions 22-23 refer to the following sign.

22. Where can you see this sign?



a. On the bookshelves b. In the meeting room

c. On the table in the library d. At the door of the library

23. What will happen to the students if they do NOT sign up?

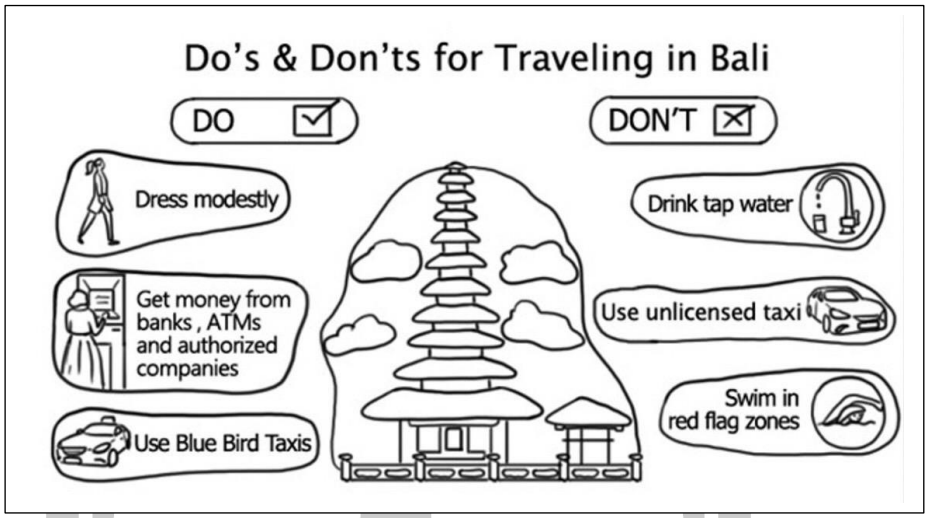
a. They are not able to select the activities they like themselves.

b. They are not able to work in the afternoon next week.

c. They are still able to select the activities next week.

d. They are able to do any activities they want.

24.



While you are travelling in Bali, you have to _____.

a. consume water from the tap

b. wear shorts when entering a temple

c. take a ride in an unauthorized taxi to get around

d. withdraw cash from automatic teller machines.

25.

DVB Pharmacy

LAMICTAL 100 mg Tab

Take 1 and ½ Tablets Every Morning & at 6 p.m.

No Refills Qty : 270

How should you take the medicine?

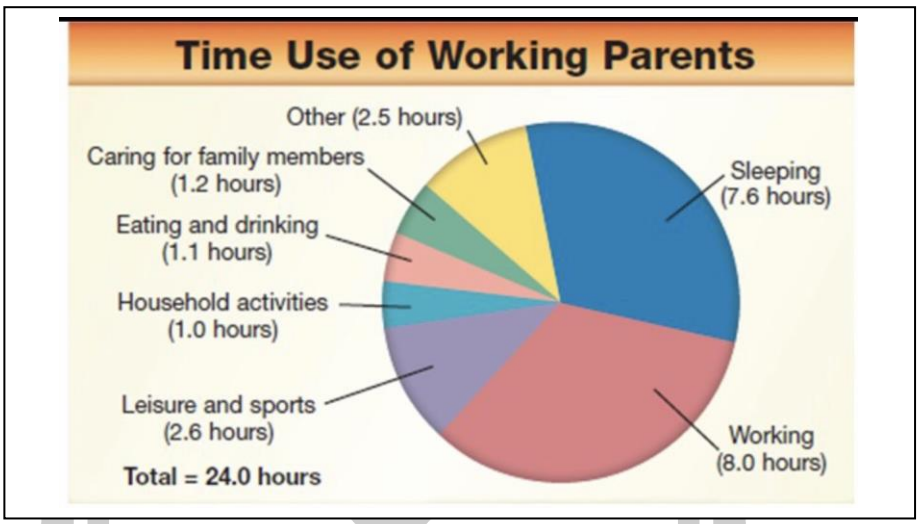
a. Take one and a half tablets at 6 o'clock in the morning.

b. Take one tablet in the morning and half a tablet at 6 p.m.

c. Take one and a half tablets in the morning and one tablet at 6 p.m.

d. Take one and a half tablets in the morning and do the same thing at 6 p.m.

26.



According to the information shown in the chart above, how would you explain about this chart?

a. People spend less time working than eating and drinking, and sleeping combined.

b. People spend as much time working as eating, drinking, and sleeping combined.

c. People spend the least time on leisure and sport but the most time on working.

d. People spend less time caring for family members than household activities.

Questions 27-29 refer to the following information.

The 30 fastest-growing occupations, 2010-2020 (in thousands)

Occupations	Employment		Change		Most significant source of postsecondary education or training
	2010	2020	Number	Percent	
Home health aides	1,018	1,724	706	69%	Short-term on-the-job training
Biomedical engineers	16	26	10	63%	Bachelor degree
Carpenters	46	72	26	56%	Short-term on-the-job training
Physical therapist aides	47	67	20	43%	None
Dental hygienists	180	250	70	39%	Associate degree
Health educators	64	87	23	36%	Bachelor degree

27. Which occupation will grow the least from 2010 to 2020?

a. Biomedical engineers
b. Dental hygienists
c. Home health aides
d. Health educators

28. What is NOT true about homes health aides?

a. It requires a short-term on-the-job training.
b. From 2010 to 2020, this job will grow by 69%.
c. In 2010, there were 1,724,000 homes health aides.
d. There will be 706 more homes health aides in 2010.

29. According to the information, we can infer that _____.

a. the tendency of job employment in 2010 and 2020 is not different
b. all occupations require postsecondary education or training
c. jobs that are related to health will be needed most in 2020
d. carpenters will not be important in 2020

Questions 30-31 refer to the following notice.

Thai-L- GYM

Free Weights, Treadmills, Yoga& Aerobic Classes, Personal Trainers…..

We have 5,000 square feet of floor space, so there is waiting for equipment!

Open daily

Monday-Friday: 9 am-11 pm

Saturday & Sunday: 6 am-10 pm

Come in for a FREE Firness Evaluation

We will assess your weight, % body fat, and help you determine your fitness goals.

We also have a day-care center.

Address: Thai-L GYM, Tambon Ban Pet, Mueang, Khon Kaen, Thailand
Phone:+66 87 499 2436

30. What service does this gym off at no charge?

a. Free fitness assessment
b. Free personal trainers
c. Free weights
d. Free yoga

31. What feature would be most appealing to parents?

a. Treadmills
b. Flexible hours
c. Day-care center
d. No waiting for equipment

Questions 32-33 refer to the following ad.

32. Which shop would you contact if you want to hire someone to create a website?

a. B&B IT Services

b. Greenwood Shop

c. JT Computer Academy

d. Advanced Computer Shop

33. Which number should you call if you want to have your computer fixed?

a. 09-3823-1118

b. 09-3093-2555

c. 08-3665-3252

d. 08-9999-9223

Questions 34-36 refer to the following text.

NEW PRODUCT

The new Futura 320 Laser Printer is here! It has a high-speed processor for quick processing of documents with complex visuals. It delivers 30 clear, crisp copies per minute. It is compatible with both Windows and Apple operating systems. It comes with a 700-sheet paper tray, and can take three more trays for a maximum paper capacity of 2,300 sheets for much faster paper reloading. The new Futura 320 Laser Printer—for speedy, high-quality printing you can always trust!

34. What does the text emphasize?

a. The availability of the new Futura 320 Laser Printer

b. The size of the new Futura 320 Laser Printer

c. The cost of the new Futura 320 Laser Printer

d. The speed of the new Futura 320 Laser Printer

35. How many sheets of paper can the printer tray hold up?

a. About 2100

b. Less than 320

c. At most 2,300

d. More than 2,300

36. Which of the following printing jobs would be best used by the Futura 320 Laser Printer?

a. A book containing text entirely

b. A company's financial statement

c. Handwritten letters for reproduction

d. A stack of paperwork with heavy visuals

Questions 37-41 refer to the following advertisement and email.

SCUBA DIVING EXCURSION

We will stay at a nice beachfront hotel Friday night then roll out of bed to go do a deep wreck – CAP. Dan (110 feet deep) followed by Copenhagen (43 feet deep).

Saturday afternoon, you can do an optional beach dive or spend the day shopping or on the beach across the street from the hotel.

Saturday night, we dive on the Racy (75 feet deep) followed by Caves (30 feet another night at the hotel, we will roll out of bed and do two more great dives.

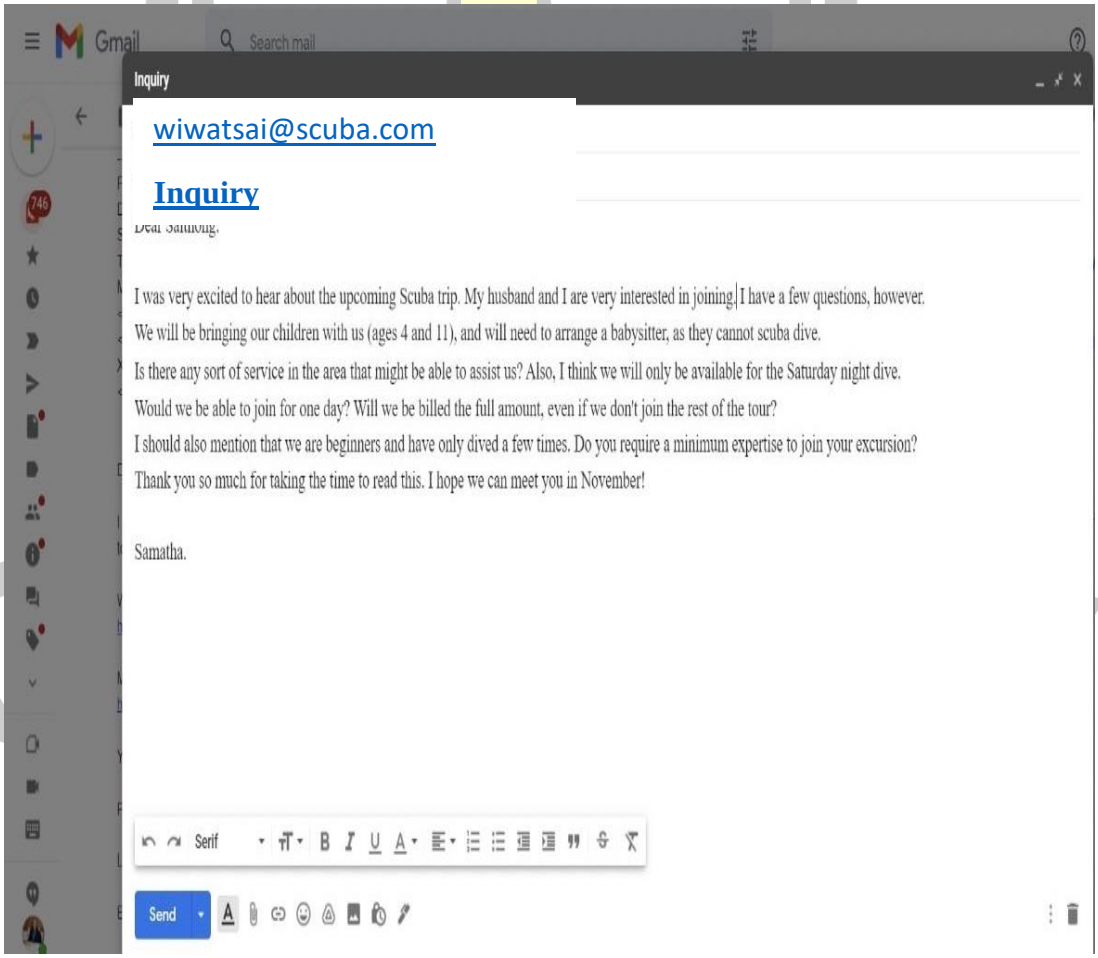
Where: Ka ta Beach, Phuket, Thailand

When: November 12-14, 2021

Price: 3,500 THB per Diver

Contact: Wiwat Saithong Email: wiwatsai@scuba.com

Phone: 097-452-4888



Dear Saithong:

I was very excited to hear about the upcoming Scuba trip. My husband and I are very interested in joining. I have a few questions, however. We will be bringing our children with us (ages 4 and 11), and will need to arrange a babysitter, as they cannot scuba dive. Is there any sort of service in the area that might be able to assist us? Also, I think we will only be available for the Saturday night dive. Would we be able to join for one day? Will we be billed the full amount, even if we don't join the rest of the tour? I should also mention that we are beginners and have only dived a few times. Do you require a minimum expertise to join your excursion?

Thank you so much for taking the time to read this. I hope we can meet you in November!

Samatha.

37. What service does Wiwat Saithong NOT likely provide?

a. Food preparation
b. Guided tours of sites
c. Scuba gear maintainance
d. Transportation to different sites

38. What most likely are Cap. Dan and Copenheagen?

a. Shops
b. Sunken ships
c. Seafood
d. Restaurants

39. How many children does Samantha have?

a. One
b. Two
c. Three
d. Four

40. What is Samantha's scuba ability level?

a. Novice
b. Intermediate
c. Advanced
d. Expert

41. What question will Wiwat NOT answer in his response?

a. Price reduction
b. Water temperature
c. Details on children
d. Comment on ability level

For centuries, people thought a giant monster lived beneath the waters of Lake Ness, a big deep freshwater loch in Scotland. The Loch Ness Monster, sometimes referred to as Nessie, is thought to be a long-necked monster. According to several, they saw something moving in the water, resembling a gigantic snake. Several photographers have captured images of a creature in the water. However, no one has ever proved the Loch Ness Monster's existence.

Passage 1 (Questions 42-44)

42. Which sentence is NOT the detail of the Loch Ness Monster?

a. It is big.
b. It is a snake.
c. It is a monster.
d. It is under the lake.

43. Which word has the same meaning as 'Loch'?

a. pool
b. lake
c. desert
d. village

44. Which sentence is true about Nessie?

a. It is still a belief.
b. It is a snake in Scotland.
c. Someone has taken a photo of it.
d. Someone has seen it in the sea.

When you first arrive on campus, you may notice how friendly everyone is. People you don't know will smile and say "Hi" and "How are you" and "How's it going." You will notice that these are not really questions; people will most often keep on walking rather than waiting for your answer. You may get the idea they are **superficial** or perhaps even rude.

Americans, however, feel that this kind of greeting and behavior is considered very friendly; they feel they are outgoing and welcoming. These greetings are a social custom that has little to do with friendship. The person may become your friend eventually, but it is important not to misunderstand the nature of your verbal exchange.

Similarly, people may ask your name and country where you were born; they may seem interested for a few minutes, but then go and speak to someone else. This may seem to contradict their initial friendliness, although it is not meant to do so.

Passage 2 (Questions 45-47)

45. The passage is for _____.

a. students newly enrolling in college

b. hosts welcoming American students

c. international students first going to America

d. American visiting campus in another country

46. In your country, people consider asking a question and not waiting for a reply impolite,

but, in America, people can ask "How's it going?" and walk away because _____.

a. it's just greeting

b. They are rude people

c. it's not an important question

d. they are not friendly people

47. According to the passage, American shows friendliness at the first meeting by _____.

a. smiling and being quiet
b. discussing other's social custom
c. greeting and asking a few questions
d. paying attention to other's behavior

One of the elephant communication mysteries looks to have been resolved. According to studies, elephants communicate with one another using a variety of movements and gestures. To the casual observer, a curled trunk, a backward stride, or an ear fold may appear meaningless. However, elephants and scientists agree that some signals carry critical information to individual elephants and the herd as a whole.

Biologists and conservationists have created an online database for interpreting the signals of hundreds of elephants. They attempt to decipher the meaning of the various **rumbling**, screaming, and other noises made by elephants in conjunction with various postures such as flapping their ears or curling their trunks. Scientists categorize the gestures they saw in their fieldwork into nine categories: attentive, aggressive, ambivalent, defensive, social integrating, mother-offspring, sexual, playful, and dead.

Passage 3 (Questions 48-51)

48. What does the passage mainly discuss?

a. How scientists classify elephants
b. The ways elephants communicate
c. The ways to communicate with animals
d. How to understand the nature of elephants

49. Which word is the closest meaning to "rumbling"?

a. vibrating
b. moaning
c. laughing
d. complaining

50. According to the passage, which is NOT true?

a. Normal observers may not understand the elephant's gestures.

b. The scientist classified nine types of elephant's gestures.

c. Scientists create a system that enables the interpretation of elephants' gestures.

d. Scientists can decode the signals from elephants when they hear their footsteps.

51. What can be inferred from this passage?

a. Elephants can speak many languages.

b. Elephants can play instruments in music concerts.

c. It is hard for scientists to identify elephants' languages.

d. Elephants communicate with each other by making sounds and gestures.

พหุน ปณ ฑิโต ชีเว

The Mormons - A Curiously American Phenomenon

(1) Mormonism was founded in the 19th century by a man called Joseph Smith, who said that God had shown him a third testament of the Bible, the "Book of Mormon", written in a strange language, on leaves of gold. (2) Smith translated this divine book into English, and convinced a lot of people that his story was true. (3) Nobody else ever found the books of gold.

(4)The Mormons have been perceived as one of the weirdest and most wonderful religious groups in the United States. (5) This church, with its peculiar mixture of Christianity and apparent mythology, has survived and prospered, becoming one of the most powerful churches in America, controlling (as it always has done) the state of Utah, and possessing **enormous** wealth.

(6) Most Mormons live very sober lives, respect strict codes of moral behaviour, and give a tenth of their income to the church. (7) Visitors to Salt Lake City, the capital of Utah, may complain that they find it hard to buy alcoholic drinks. However, they appreciate the city's low crime rate and clean streets and are full of praise for Mormon hospitality and helpfulness. (8) On the negative side, though, Utah has one of the highest rates of suicide and depression in the United States.

Passage 4 (Questions 52-56)

52. According to the passage, which of the following is TRUE?

a. Certain aspects of Mormonism involve ancient stories and beliefs.

b. The sale of alcoholic beverages is prohibited in Utah's Salt Lake City.

c. Mormonism is the strangest and most influential religion in the United States.

d. It has been proved that the books of gold cited by Joseph Smith never existed.

53. Which of the following sentences in the passage shows the characteristics shared by the Mormons and Thai people in general?

a. 4 b. 5

c. 6 d.7

54. The word "**enormous"** refers to _____.

a. gigantic b. small

c. trifling d. slight

55. Which of the following is likely to be the cause of the staggering rates of suicide and depression among the Mormons in Utah?

a. They have no freedom in life as they must commit themselves completely to their religion.

b. They are barred from alcoholic consumption and non-religious activities, thus having no chance to enjoy life.

c. They are not accepted by those of other faiths and beliefs in the country, resulting in shame and disappointment.

d. They have to live sober lives restricted by strict sets of religious rules.

56. The tone of this passage is _____.

a. miserable b. horrifying

c. factual d. controversial

Passage 5 (Questions 57-60)

Despite the low likelihood of coffee "**sending you to your grave"** abruptly, there have been popular close calls. According to experts, you would need to consume between 80 and 100 cups of coffee in rapid succession, which is around 6 gallons (23 liters) of coffee or 10 to 13 grams of pure caffeine. And even if you could drink that much coffee, the additional water in your body would eventually kill you by diluting vital nutrients in your bloodstream. While it takes a lot to kill, it just takes a lot to induce adverse effects, and the long-term implications of caffeine are unclear.

This month, according to news accounts, a young United Kingdom woman drank seven double-shots of espresso in four hours. The barista binge sent her gasping for breath with a racing heart on the way to the emergency room. She fully recovered within a day from the overdose, and doctors explained she had ingested three times the safe daily amount of caffeine (about 300 milligrams or two to three coffee cups worth of caffeine).

However, if our espresso-fanatic woman was a man, the situation could have been **direr**, as females can break down caffeine 25 % faster than males.

But how, exactly, can the world's most popular drug kill?

Like other stimulants, caffeine raises blood pressure, boosts heart rate and temporarily shrinks blood vessels. In excess, **its** effects can be deadly by causing a heart attack, stroke or other cardiovascular-related problems.

57. It can be concluded from the first paragraph that _____.

a. it is impossible that a person will die from consuming too much water

b. it is less likely that a person can die from drinking too much coffee

c. it is improbable that a person may lose nutrients from his/her circulation after consuming an adequate amount of water

d. it is verified that an individual who consumes an excessive amount of coffee is less healthful.

58. According to the doctor, the young United Kingdom woman _____.

a. took in about 300 milligrams of coffee

b. consumed three coffee cups worth of caffeine

c. ingested too much coffee that led to serious health conditions

d. gasped for breath as she had a heart attack

59. The word "**its**" (line 19) refers to _____.

a. coffee's b. heart rate's

c. caffeine's d. the blood vessel's

60. The best title for this passage is _____.

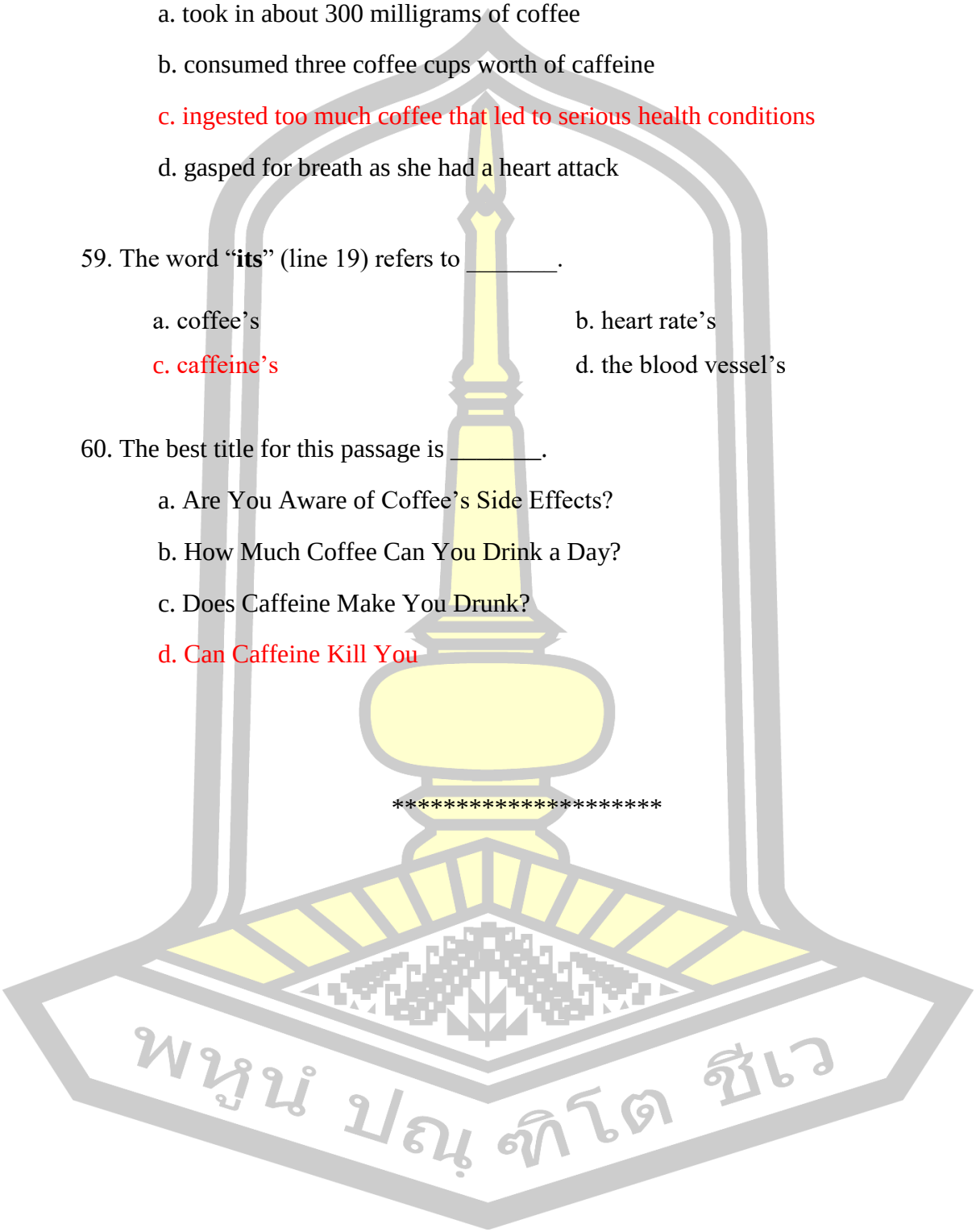
a. Are You Aware of Coffee's Side Effects?

b. How Much Coffee Can You Drink a Day?

c. Does Caffeine Make You Drunk?

d. Can Caffeine Kill You

****



Appendix B: Trait and State EFL Reading Comprehension Test Strategy Use Questionnaire

Directions: The purpose of this survey is to collect information about various strategies you use when taking academic reading comprehension tests. Each statement is followed by five numbers, 0, 1, 2, 3, 4, and 5, and each number means the following:

0 means “I never do this.” (ฉันไม่เคยทำสิ่งนี้)

1 means “I rarely do this.” (ฉันเกือบจะไม่เคยสิ่งนี้)

2 means “ I do this only occasionally.” (ฉันทำสิ่งนี้แค่บางครั้ง)

3 means “I sometimes do this.” (about 50%of the time) (ฉันทำสิ่งนี้ประมาณ 50%)

4 means “I usually do this.” (ฉันทำสิ่งนี้เป็นประจำ)

5 means that “I always or almost always do this.” (ฉันทำสิ่งนี้เสมอหรือเกือบทุกครั้ง).

Read each statement and indicate how you usually think or do when taking academic reading comprehension tests. Then, circle the number (0, 1, 2, 3, 4, or 5) which applies to you. Note that there is no right or wrong response to any of the items on this survey.

The researcher would like you to fill in all of the statements, show your thinking truthfully, and greatly appreciate your precious time to do this questionnaire.

พหุน ปณ ฑิโต ชีเว

No	Your thinking	Never					Always
1	I make a plan before I begin the reading comprehension test. ฉันวางแผนก่อนเริ่มทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
2	I make sure I understand the goals of the reading comprehension test tasks. ฉันมั่นใจว่าฉันเข้าใจเป้าหมายของแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
3	I think about what I need to do to complete the reading comprehension test. ฉันคิดเกี่ยวกับสิ่งที่ฉันต้องทำเพื่อการทำแบบทดสอบการอ่านจับใจความให้เรียบร้อย	0	1	2	3	4	5
4	I make sure I know what to do and how to do the reading comprehension test. ฉันมั่นใจว่าฉันรู้ว่าอะไรคือสิ่งที่ฉันต้องทำและทำโดยวิธีการใดในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
5	I know what to do if my plans do not work well as planned when I complete the reading comprehension test. ฉันรู้ว่าต้องทำอะไรเพื่อให้เป็นไปตามแผนที่ได้วางไว้ในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
6	Before working on the reading comprehension test tasks, I quickly scan them. ฉันเปิดแบบทดสอบการอ่านจับใจความดูแบบผ่านๆก่อนเริ่มลงมือทำแบบทดสอบ	0	1	2	3	4	5
7	Test questions help me in identifying my reading purpose. ข้อคำถามในแบบทดสอบช่วยฉันจำแนกจุดมุ่งหมายในการอ่าน	0	1	2	3	4	5
8	Before I start reading, I take a quick look at the text to understand it. ฉันกวาดสายตาดูเนื้อความอย่างรวดเร็วเพื่อทำความเข้าใจเนื้อความก่อนฉันเริ่มอ่าน	0	1	2	3	4	5
9	I provide a preview of the first by highlighting its length and arrangement. ฉันเตรียมการดูภาพรวมเป็นอันดับแรกโดยเน้นที่ความยาวและการจัดเรียงเนื้อหา	0	1	2	3	4	5
10	Before starting the reading comprehension test, I look at it a few times to see how it goes. ฉันเปิดดูแบบทดสอบการอ่านจับใจความ 2-3 ครั้งว่ามีข้อสอบอะไรบ้างก่อนเริ่มลงมือทำแบบทดสอบ	0	1	2	3	4	5
11	I look at the first sentence of each paragraph to get the main idea. ฉันอ่านประโยคแรกของแต่ละย่อหน้าเพื่อจับใจความสำคัญ	0	1	2	3	4	5
12	I try figuring out how the main ideas in the text are linked together. ฉันพยายามที่จะหาใจความสำคัญของข้อความที่เชื่อมโยงกัน	0	1	2	3	4	5
13	I try to understand what I am reading and skip unknown words. ฉันพยายามที่จะทำความเข้าใจสิ่งที่กำลังอ่านและข้ามคำศัพท์ที่ฉันไม่รู้	0	1	2	3	4	5
14	I look for words or phrases I want to find as I read.	0	1	2	3	4	5

No	Your thinking	Never					Always
	ฉันมองหาคำศัพท์หรือวลีที่ฉันต้องการหาในขณะที่ฉันอ่าน						
15	During reading, I think about what will happen next. ฉันคิดว่าจะเกิดอะไรขึ้นเป็นอันดับต่อไปในที่ฉันกำลังอ่าน	0	1	2	3	4	5
16	I interpret what the author intends or tries to communicate. ฉันแปลสิ่งที่ผู้เขียนตั้งใจหรือพยายามสื่อสาร	0	1	2	3	4	5
17	I use typographic features like boldface and italics to help me find important information. ฉันใช้ลักษณะของการพิมพ์ เช่น ตัวหนา ตัวเอียง เพื่อช่วยฉันหาข้อมูลสำคัญ	0	1	2	3	4	5
18	When parts of the text are hard to understand, I reread them to understand better. ฉันอ่านข้อความอีกครั้งเพื่อให้เข้าใจมากยิ่งขึ้นเมื่อบางส่วนของข้อความนั้นยากที่จะทำความเข้าใจ	0	1	2	3	4	5
19	When I do not understand something, I read it repeatedly until I do. ฉันอ่านซ้ำไปซ้ำมาจนกระทั่งฉันเข้าใจข้อความเมื่อฉันไม่เข้าใจในบางเนื้อหา	0	1	2	3	4	5
20	I try to decipher hidden concepts/meanings in texts. ฉันพยายามถอดความคอนเซปท์หรือความหมายที่ซ่อนไว้ในข้อความ	0	1	2	3	4	5
21	I use my first language to translate reading texts. ฉันใช้ภาษาแม่(ภาษาไทย)ในการแปลข้อความที่อ่าน	0	1	2	3	4	5
22	If I grasp some sections, I will use them as a starting point for understanding others. ถ้าฉันสรุปเนื้อหาบางส่วนได้ ฉันจะใช้เนื้อหาส่วนนั้นเป็นจุดเริ่มต้นในการทำความเข้าใจส่วนอื่นๆ	0	1	2	3	4	5
23	I read the text for what it says on the surface and what it means in the background. ฉันอ่านข้อความเพื่อดูว่าเรื่องกล่าวถึงอะไรและความหมายโดยนัยที่ซ่อนอยู่ในข้อความ	0	1	2	3	4	5
24	I sum up the most important parts of the text. ฉันสรุปส่วนที่สำคัญที่สุดของข้อความ	0	1	2	3	4	5
25	I use my prior knowledge or experience to read the reading texts. ฉันใช้ความรู้เดิมหรือประสบการณ์เดิมเพื่ออ่านข้อความในบทอ่าน	0	1	2	3	4	5
26	I am aware of which information is more or less relevant. ฉันตระหนักว่าข้อมูลใดมีความเกี่ยวข้องมากหรือน้อย	0	1	2	3	4	5
27	I use context clues to determine or guess the meanings of unknown words. ฉันใช้บริบทเพื่อแปลหรือเดาความหมายคำศัพท์ที่ไม่รู้	0	1	2	3	4	5
28	I use the grammar rules I have learned when I read or do reading tasks. ฉันใช้หลักไวยากรณ์ที่ได้เรียนมาเมื่อฉันอ่านหรือทำแบบทดสอบการอ่าน	0	1	2	3	4	5
29	Root words help me figure out the meanings of words I do	0	1	2	3	4	5

No	Your thinking	Never					Always
	not know. รากศัพท์ช่วยฉันในการหาความหมายของคำศัพท์ที่ฉันไม่รู้						
30	I infer the information from the texts. ฉันตีความข้อมูลจากข้อความ	0	1	2	3	4	5
31	I try to comprehend by drawing on my existing knowledge. ฉันพยายามสรุปความโดยการวาดภาพบนความรู้ที่ฉันมีอยู่	0	1	2	3	4	5
32	I am aware of the limitations and constraints imposed by time. ฉันตระหนักว่าข้อจำกัดและข้อบังคับถูกกำหนดโดยเวลา	0	1	2	3	4	5
33	I am aware of the amount of reading and tasks that must be completed while reading. ฉันตระหนักถึงจำปริมาณในการอ่านและภาระงานที่ต้องทำให้เรียบร้อยในขณะที่อ่าน	0	1	2	3	4	5
34	I am aware of when and where I am confused in the text. ฉันตระหนักว่าเมื่อไหร่และจุดไหนที่ฉันกำลังสับสนในข้อความ	0	1	2	3	4	5
35	I know when I am anxious, tense, or uninterested when reading. ฉันรู้ว่าเมื่อไหร่ที่ฉันกำลังรู้สึกตื่นเต้น กดดัน หรือไม่น่าสนใจในขณะที่กำลังอ่าน	0	1	2	3	4	5
36	I am aware when I lose attention while reading. ฉันรู้ว่าเมื่อไหร่ที่ฉันไม่มีความสนใจในขณะที่กำลังอ่าน	0	1	2	3	4	5
37	I will double-check how well I understand what I read or how well I did. ฉันจะตรวจสอบสองชั้นเพื่อตรวจสอบว่าฉันเข้าใจสิ่งที่อ่านมากน้อยเพียงใดหรือฉันทำได้ดีเพียงใด	0	1	2	3	4	5
38	I am aware of when I do and do not comprehend something. ฉันตระหนักว่าเมื่อใดฉันสรุปความได้หรือไม่ได้ในบางเรื่อง	0	1	2	3	4	5
39	I know when I should pay more attention to the reading comprehension test. ฉันรู้ว่าเมื่อใดฉันควรจะให้ความสนใจแบบทดสอบการอ่านจับใจความมากยิ่งขึ้น	0	1	2	3	4	5
40	To speed up the reading comprehension test, I know when I should finish it more quickly. ฉันรู้ว่าเมื่อใดฉันควรจะทำแบบทดสอบให้เสร็จเร็วยิ่งขึ้นเพื่อเป็นการเร่งความเร็วในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
41	I manage the time effectively on the reading comprehension test. ฉันบริหารเวลาอย่างมีประสิทธิภาพในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
42	I will quickly correct a misunderstanding or a mistake when I find it. เมื่อฉันพบข้อผิดพลาด ฉันจะรีบแก้ไขสิ่งที่เข้าใจผิดหรือทำผิดทันที	0	1	2	3	4	5
43	I adapt reading speed to increase comprehension.	0	1	2	3	4	5

No	Your thinking	Never					Always
	ฉันเปลี่ยนแปลงความเร็วในการอ่านเพื่อเพิ่มสรุปความได้เร็วขึ้น						
44	I adapt my pace in answering questions. ฉันเปลี่ยนแปลงความเร็วในการตอบคำถาม	0	1	2	3	4	5
45	I use context clues to enhance my reading comprehension from the text. ฉันใช้บริบทจากบทอ่านเพื่อเพิ่มความสามารถการอ่านจับใจความของฉัน	0	1	2	3	4	5
46	I verify that I comprehend the content or task. ฉันตรวจสอบว่าฉันสรุปใจความจากเนื้อหาหรือภาระงาน	0	1	2	3	4	5
47	I evaluate my own performance and progress through the reading tasks. ฉันประเมินความสามารถและกระบวนการของฉันผ่านเรื่องที่อ่าน	0	1	2	3	4	5
48	I am continuously evaluating my reading strategies or goals. ฉันดำเนินการประเมินกลยุทธ์หรือเป้าหมายในการอ่านต่อไปเรื่อย ๆ	0	1	2	3	4	5
49	I will take notes to enhance my reading comprehension. ฉันจะบันทึกข้อความเพื่อเพิ่มความสามารถในการอ่านจับใจความ	0	1	2	3	4	5
50	I will restate in my own words to better understand the text. ฉันจะกล่าวซ้ำในคำพูดของตนเองเพื่อความเข้าใจในการอ่านข้อความมากยิ่งขึ้น	0	1	2	3	4	5
51	I will consider whether the text content is appropriate for my reading purpose. ฉันจะพิจารณาว่าเนื้อหาในข้อความเหมาะสมกับจุดมุ่งหมายในการอ่านของฉันหรือไม่	0	1	2	3	4	5

พหุน ปณ ฑิโต ชีเว

State EFL reading comprehension test strategy use questionnaire

Directions: The purpose of this survey is to collect information about various strategies you use after you took academic reading comprehension tests. Each statement is followed by five numbers, 0, 1, 2, 3, 4, and 5, and each number means the following:

0 means "I never did this." (ฉันไม่เคยทำสิ่งนี้)

1 means "I rarely did this." (ฉันเกือบจะไม่เคยสิ่งนี้)

2 means " I did this only occasionally." (ฉันทำสิ่งนี้แค่บางครั้ง)

3 means "I sometimes did this." (about 50%of the time) (ฉันทำสิ่งนี้ประมาณ 50%)

4 means "I usually did this." (ฉันทำสิ่งนี้เป็นประจำ)

5 means "I always or almost always did this." (ฉันทำสิ่งนี้เสมอหรือเกือบทุกครั้ง).

Read each statement and indicate how you thought or did when taking academic reading comprehension tests. Then, circle the number (0, 1, 2, 3, 4, or 5) which applies to you. Note that there is no right or wrong response to any of the items on this survey.

The researcher would like you to fill in all the statements, show your thoughts truthfully, and greatly appreciate your precious time doing this questionnaire.

No	**Your thinking**	**Never**					**Always**
1	I had made a plan before I began the reading comprehension test. ฉันได้วางแผนก่อนเริ่มทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
2	I made sure I understood the goals of the reading comprehension test tasks. ฉันได้มั่นใจว่าฉันเข้าใจเป้าหมายของแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
3	I thought about what I needed to do to complete the reading comprehension test. ฉันได้คิดเกี่ยวกับสิ่งที่ฉันต้องทำเพื่อการทำแบบทดสอบการอ่านจับใจความให้เรียบร้อย	0	1	2	3	4	5
4	I made sure I knew what to do and how to do the reading comprehension test. ฉันได้มั่นใจว่าฉันรู้ว่าอะไรคือสิ่งที่ฉันต้องทำและทำโดยวิธีการใดในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
5	I knew what to do if my plans did not work well as planned when I completed the reading comprehension test. ฉันได้รู้ว่าต้องทำอะไรเพื่อให้เป็นไปตามแผนที่ได้วางไว้ในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5

No	Your thinking	Never					Always
6	Before I started working on the reading comprehension test tasks, I had quickly scanned them. ฉันได้เปิดอ่านแบบทดสอบการอ่านจับใจความดูแบบผ่านๆก่อนเริ่มลงมือทำแบบทดสอบ	0	1	2	3	4	5
7	Test questions helped me in identifying my reading purpose. ข้อคำถามในแบบทดสอบช่วยฉันจำแนกจุดมุ่งหมายในการอ่าน	0	1	2	3	4	5
8	Before I started reading, I had taken a quick look at the text to understand what it was about. ฉันได้กวาดสายตาดูเนื้อความอย่างรวดเร็วเพื่อทำความเข้าใจเนื้อความก่อนฉันเริ่มอ่าน	0	1	2	3	4	5
9	I provided a preview of the first by highlighting its length and arrangement. ฉันได้เตรียมการดูภาพรวมเป็นอันดับแรกโดยเน้นที่ความยาวและการจัดเรียงเนื้อหา	0	1	2	3	4	5
10	Before starting the reading comprehension test, I looked at it a few times to see how it went. ฉันได้เปิดดูแบบทดสอบการอ่านจับใจความ 2-3 ครั้งว่ามีข้อสอบอะไรบ้างก่อนเริ่มลงมือทำแบบทดสอบ	0	1	2	3	4	5
11	I looked at the first sentence of each paragraph to get the main idea. ฉันได้อ่านประโยคแรกของแต่ละย่อหน้าเพื่อจับใจความสำคัญ	0	1	2	3	4	5
12	I tried figuring out how the main ideas in the text were linked together. ฉันได้พยายามหาใจความสำคัญของข้อความที่เชื่อมโยงกัน	0	1	2	3	4	5
13	I tried to understand what I was reading and skip unknown words. ฉันได้พยายามที่จะทำความเข้าใจสิ่งที่กำลังอ่านและข้ามคำศัพท์ที่ฉันไม่รู้	0	1	2	3	4	5
14	I looked for words or phrases I wanted to find as I read. ฉันได้มองหาคำศัพท์หรือวลีที่ฉันต้องการหาในขณะที่ฉันอ่าน	0	1	2	3	4	5
15	During reading, I thought about what would happen next. ฉันได้คิดว่าจะเกิดอะไรขึ้นเป็นอันดับต่อไปในที่ฉันกำลังอ่าน	0	1	2	3	4	5
16	I interpreted what the author intended or tried to communicate. ฉันได้แปลสิ่งที่ผู้เขียนตั้งใจหรือพยายามสื่อสาร	0	1	2	3	4	5
17	I used typographic features like boldface and italics to help me find important information. ฉันได้ใช้ลักษณะของการพิมพ์ เช่น ตัวหนา ตัวเอียง เพื่อช่วยฉันหาข้อมูลสำคัญ	0	1	2	3	4	5
18	When parts of the text were hard to understand, I reread them to understand better. ฉันได้อ่านข้อความซ้ำไปซ้ำมาเพื่อให้เข้าใจมากยิ่งขึ้นเมื่อบางส่วนของข้อความนั้นยากที่จะทำความเข้าใจ	0	1	2	3	4	5
19	When I did not understand something, I read it repeatedly until I did. ฉันได้อ่านซ้ำไปซ้ำมาจนกระทั่งฉันเข้าใจข้อความเมื่อฉันไม่เข้าใจในบางเนื้อหา	0	1	2	3	4	5
20	I tried to decipher hidden concepts/meanings in texts. ฉันได้พยายามถอดความคอนเซปท์หรือความหมายที่ซ่อนไว้ในข้อความ	0	1	2	3	4	5
21	I used my first language to translate reading texts.	0	1	2	3	4	5

No	Your thinking	Never					Always
	ฉันได้ใช้ภาษาแม่(ภาษาไทย)ในการแปลข้อความที่อ่าน						
22	If I grasped some sections, I would use them as a starting point for understanding others. ถ้าฉันได้สรุปเนื้อหาบางส่วน ฉันใช้เนื้อหาส่วนนั้นเป็นจุดเริ่มต้นในการทำความเข้าใจส่วนอื่นๆ	0	1	2	3	4	5
23	I read the text for what it said on the surface and what it meant in the background. ฉันได้อ่านข้อความเพื่อดูว่าเรื่องกล่าวถึงอะไรและความหมายโดยนัยที่ซ่อนอยู่ในข้อความ	0	1	2	3	4	5
24	I sum up the most important parts of the text. ฉันได้สรุปส่วนที่สำคัญที่สุดของข้อความ	0	1	2	3	4	5
25	I used my prior knowledge or experience to read the reading texts. ฉันได้ใช้ความรู้เดิมหรือประสบการณ์เดิมเพื่ออ่านข้อความในบทอ่าน	0	1	2	3	4	5
26	I was aware of which information is more or less relevant. ฉันได้ตระหนักว่าข้อมูลใดมีความเกี่ยวข้องมากหรือน้อย	0	1	2	3	4	5
27	I used context clues to determine or guess the meanings of unknown words. ฉันได้ใช้บริบทเพื่อแปลหรือเดาความหมายคำศัพท์ที่ไม่รู้	0	1	2	3	4	5
28	I used the grammar rules I have learned when I read or did reading tasks. ฉันใช้หลักไวยากรณ์ที่ได้เรียนมาเมื่อฉันอ่านหรือทำแบบทดสอบการอ่าน	0	1	2	3	4	5
29	Root words helped me figure out the meanings of words I did not know. รากศัพท์ได้ช่วยฉันในการหาความหมายของคำศัพท์ที่ฉันไม่รู้	0	1	2	3	4	5
30	I inferred the information from the texts. ฉันได้ตีความข้อมูลจากข้อความ	0	1	2	3	4	5
31	I tried to comprehend by drawing on my existing knowledge. ฉันได้พยายามสรุปความโดยการวาดภาพบนความรู้ที่ฉันมีอยู่	0	1	2	3	4	5
32	I was aware of the limitations and constraints imposed by time. ฉันได้ตระหนักว่าข้อจำกัดและข้อบังคับถูกกำหนดโดยเวลา	0	1	2	3	4	5
33	I was aware of the amount of reading and tasks that had to be completed while reading. ฉันได้ตระหนักถึงจำปริมาณในการอ่านและภาระงานที่ต้องทำให้เรียบร้อยในขณะที่อ่าน	0	1	2	3	4	5
34	I was aware of when and where I was confused in the text. ฉันได้ตระหนักว่าเมื่อไหร่และจุดไหนที่ฉันกำลังสับสนในข้อความ	0	1	2	3	4	5
35	I knew when I was anxious, tense, or uninterested when reading. ฉันได้รู้ว่าเมื่อไหร่ที่ฉันกำลังรู้สึกตื่นเต้น กดดัน หรือไม่น่าสนใจในขณะที่กำลังอ่าน	0	1	2	3	4	5
36	I was aware when I lost attention while reading. ฉันได้รู้ว่าเมื่อไหร่ที่ฉันไม่มีความสนใจในขณะที่กำลังอ่าน	0	1	2	3	4	5
37	I double-checked how well I understood what I read or how well I did. ฉันได้ตรวจสอบสองชั้นเพื่อตรวจสอบว่าฉันเข้าใจสิ่งที่อ่านมากน้อยเพียงใดหรือฉันทำได้ดีเพียงใด	0	1	2	3	4	5
38	I was aware of when I did and did not comprehend	0	1	2	3	4	5

No	Your thinking	Never					Always
	something. ฉันได้ตระหนักว่าเมื่อใดฉันสรุปความได้หรือไม่ได้ในบางเรื่อง						
39	I knew when I should pay more attention to the reading comprehension test. ฉันได้รู้ว่าเมื่อใดฉันควรจะให้ความสนใจแบบทดสอบการอ่านจับใจความมากยิ่งขึ้น	0	1	2	3	4	5
40	To speed up the reading comprehension test, I knew when I should finish it more quickly. ฉันได้รู้ว่าเมื่อใดฉันควรจะทำแบบทดสอบให้เสร็จเร็วยิ่งขึ้นเพื่อเป็นการเร่งความเร็วในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
41	I managed the time effectively on the reading comprehension test. ฉันได้บริหารเวลาอย่างมีประสิทธิภาพในการทำแบบทดสอบการอ่านจับใจความ	0	1	2	3	4	5
42	I would quickly correct a misunderstanding or a mistake when I found it. เมื่อฉันพบข้อผิดพลาด ฉันได้รีบแก้ไขสิ่งที่เข้าใจผิดหรือทำผิดทันที	0	1	2	3	4	5
43	I adapted reading speed to increase comprehension. ฉันได้เปลี่ยนแปลงความเร็วในการอ่านเพื่อเพิ่มสรุปความได้เร็วขึ้น	0	1	2	3	4	5
44	I adapted my pace in answering questions. ฉันได้เปลี่ยนแปลงความเร็วในการตอบคำถาม	0	1	2	3	4	5
45	I used context clues to enhance my reading comprehension from the text. ฉันใช้บริบทจากบทอ่านเพื่อเพิ่มความสามารถการอ่านจับใจความของฉัน	0	1	2	3	4	5
46	I verified that I comprehended the content or task. ฉันได้ตรวจสอบว่าฉันสรุปใจความจากเนื้อหาหรือภาระงาน	0	1	2	3	4	5
47	I evaluated my own performance and progress through the reading tasks. ฉันได้ประเมินความสามารถและกระบวนการของฉันผ่านเรื่องที่อ่าน	0	1	2	3	4	5
48	I was continuously evaluating my reading strategies or goals. ฉันได้ดำเนินการประเมินกลยุทธ์หรือเป้าหมายในการอ่านต่อไปเรื่อย ๆ	0	1	2	3	4	5
49	I took notes to enhance my reading comprehension. ฉันได้บันทึกข้อความเพื่อเพิ่มความสามารถในการอ่านจับใจความ	0	1	2	3	4	5
50	I restated in my own words to better understand the text. ฉันได้กล่าวซ้ำในคำพูดของตนเองเพื่อความเข้าใจในการอ่านข้อความมากยิ่งขึ้น	0	1	2	3	4	5
51	I considered whether the text content was appropriate for my reading purpose. ฉันได้พิจารณาว่าเนื้อหาในข้อความเหมาะสมกับจุดหมายในการอ่านของฉันหรือไม่	0	1	2	3	4	5

Appendix C: Interview questions

The retrospective interview will cover the following areas:

1. Can you tell me about what you did when you read this passage (i.e. before/while/after reading the passage)? Tell me about the strategies you used to help you understand.

2. What strategies did you use to help in answering the questions?

3. How did you use the reading passage to support your response/answer?

4. Did you randomly guess on any EFL reading questions? If so, on what type of questions (i.e., factual, vocabulary, inferential) did you guess randomly? Why?

5. Which question format do you think improved your reading comprehension more? Why do you think they helped you understand the reading passages?

พหุน ปณ ฑิโต ชีเว

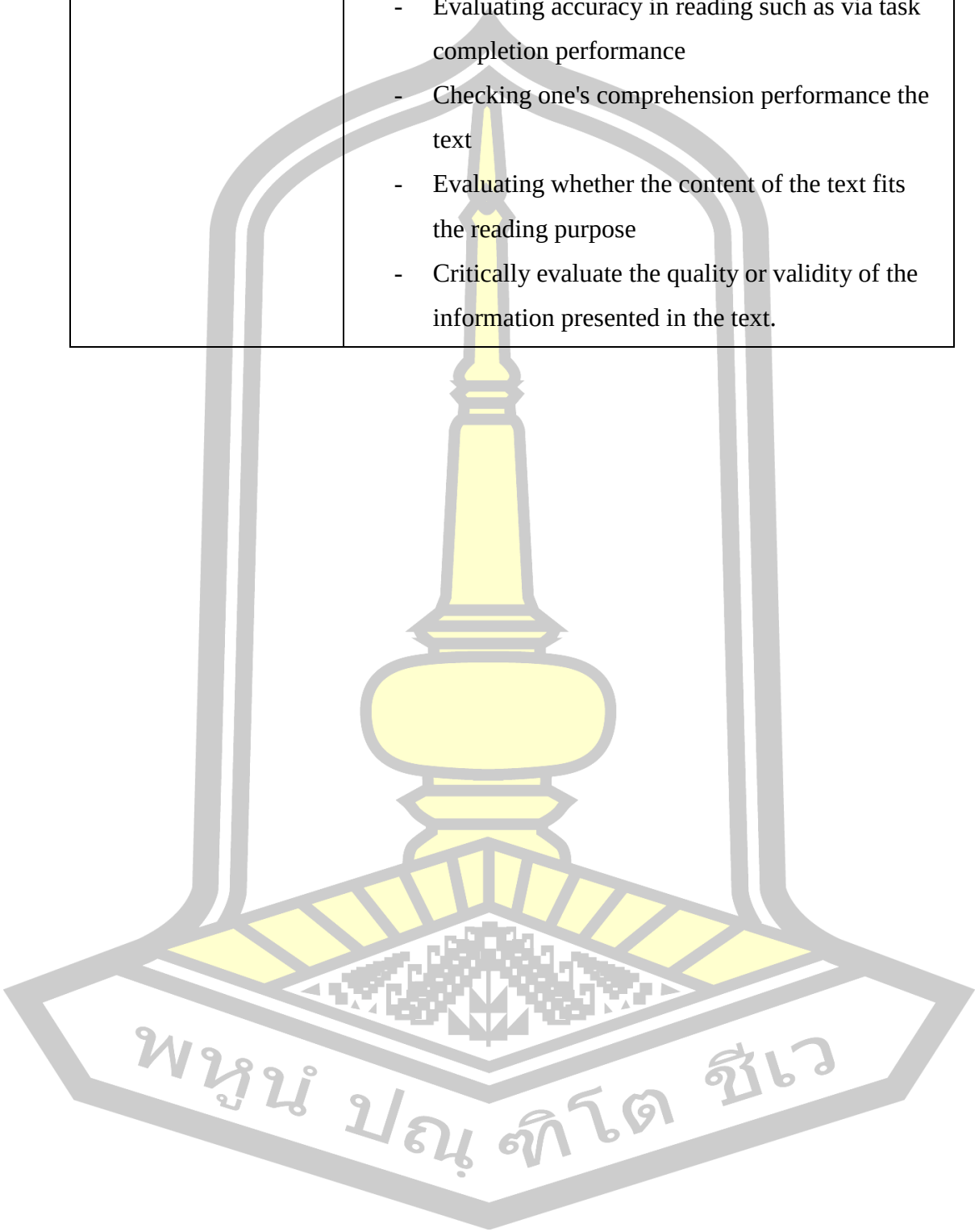
Appendix D: Taxonomy of Cognitive and Metacognitive strategies for EFL Reading

The following are plausible individual cognitive, metacognitive and affective processes involved in L2 reading that can be interpreted within a human information processing model (Phakiti, 2007 p.229-231).

Cognitive strategies	
Comprehending strategies (Q.11-16)	- Identifying main ideas, author's attitudes/tones - Summarising main information - Analysing the author's purposes - Attempting to connect relationships among ideas within the text - Predicting the upcoming information while reading the current text - Using typographical features such as italics and bold faces that may signal important information - Using tables, figures or pictures to help comprehend text - Translating message into the native language - Guessing the meaning of unknown words using context clues - Using a dictionary - Clarify indirect meaning - Distinguishing facts from opinions - Making inferences based on the available information - Connecting important ideas in the text
Memory strategies (Q.17-24)	- Making use of available typographical features such as the boldface, italics, pictures, tables or figures in text - Rereading - Note taking, underlining main ideas or

	highlighting important information - Recognising previous read words or information - Paraphrasing or simplifying information to remember
Retrieval strategies (Q.25-31)	- Using prior knowledge or experience relevant to the topic - Relating new information in text with previously read text - Using grammar rules to understand meanings - Applying knowledge of word stems, prefixes or suffixes to guess the meaning of unknown words - Recalling reading purposes/task obligation
Metacognitive strategies	
Planning strategies (Q.1-10)	- Setting reading purposes or goals Keeping reading purposes or goals in mind - Figuring out what needs to be accomplished - Identifying reading task expectations - Planning steps or actions before reading - Overviewing texts or reading tasks (e.g. text organisation and length) before reading - Determining when to read carefully
Monitoring strategies (Q.32-45)	- Checking if comprehension occurs - Checking comprehension when coming across new information - Controlling concentration or attention during reading - Noticing when confusion occurs - Double-checking comprehension when encountering ambiguous information
Evaluating strategies (Q.46-51)	- Assessing levels of text difficulty and reading demands

	- Engaging self-questioning while or after reading - Evaluating accuracy in reading such as via task completion performance - Checking one's comprehension performance the text - Evaluating whether the content of the text fits the reading purpose - Critically evaluate the quality or validity of the information presented in the text.



Appendix E: Ethics approval

MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR
RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 299-271/2022

Title : An Investigation into Cognitive and Metacognitive Strategy Use and its Relationships to EFL Reading Test Performance: A Structure Equation Modelling Approach.

Principal Investigator : Mrs. Panassanan Kitichaidateanan
Responsible Department : Faculty of Humanities and Social sciences
Research site : Khon Kaen Province

Review Method : Expedited Review

Date of Manufacture : 26 August 2022 **expire :** 25 August 2023

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Mahasarakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.

Ratree S.

(Asst. Prof. Ratree Sawangjit)
Chairman

Approval is granted subject to the following conditions: (see back of this Certificate)

Appendix F: Student Participant Consent Form

ECMSU01-06.02

แบบยินยอมให้ทำการวิจัยสำหรับอาสาสมัครอายุ 7-18 ปี

ข้าพเจ้า (นาย /นาง /นางสาว).....นามสกุล.....อายุ.....ปี เกี่ยวข้อง
เป็นบิดา/มารดา/ผู้ปกครองของ (ด.ญ./ด.ช./นาย/นางสาว).....นามสกุล.....อายุ.....ปี

ขอแสดงความยินยอมให้เด็กในปกครองของข้าพเจ้าเข้าร่วมการวิจัย ในโครงการวิจัยเรื่อง "การใช้กลยุทธการรู้คิดและอภิปัญญาและความสัมพันธ์ระหว่างการทำแบบทดสอบการอ่านภาษาอังกฤษในฐานะเป็นภาษาต่างประเทศกับการสร้างโมเดลสมการโครงสร้าง"

ข้าพเจ้าและเด็กในปกครอง/ในความดูแลของข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ ข้าพเจ้าได้อ่านรายละเอียดในแบบชี้แจงสำหรับอาสาสมัครหรือผู้มีส่วนร่วมในการวิจัยโดยตลอดและได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ตลอดจนการรับรองจากผู้วิจัยที่จะเก็บรักษาข้อมูลของเด็กในปกครองของข้าพเจ้าไว้เป็นความลับ และจะไม่ระบุชื่อหรือข้อมูลส่วนตัวเป็นรายบุคคลต่อสาธารณชน โดยผลการวิจัยจะนำเสนอในลักษณะภาพรวมที่เป็นการสรุปผลการวิจัยเพื่อประโยชน์ทางวิชาการเท่านั้น

ข้าพเจ้าจึงสมัครใจให้เด็กในปกครอง/ในความดูแลของข้าพเจ้าเข้าร่วมในโครงการวิจัยนี้ ภายใต้เงื่อนไขที่ระบุไว้ในแบบชี้แจงอาสาสมัคร โดยข้าพเจ้ายินยอมให้เด็กในปกครอง/ในความดูแลของข้าพเจ้า เข้าร่วมในการวิจัย และเด็กในปกครอง/ในความดูแลของข้าพเจ้าสมัครใจเข้าร่วมการวิจัยนี้ ภายใต้เงื่อนไขที่ระบุไว้ในแบบชี้แจงอาสาสมัคร เด็กจะได้ทำแบบทดทอบวัดความรู้การอ่านภาษาอังกฤษ จำนวน 2 ครั้ง และแบบสอบถามเกี่ยวกับการใช้กลยุทธการรู้คิดและอภิปัญญาและความสัมพันธ์ระหว่างการทำแบบทดสอบการอ่านภาษาอังกฤษ เมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัยจะถูกทำลาย ได้แก่ ข้อมูลผลการทดสอบวัดความรู้ และรายชื่อนักเรียนที่เข้าร่วม

ข้าพเจ้ามีสิทธิให้ผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้าหรือเป็นความประสงค์ของผู้ที่อยู่ในปกครอง/ในความดูแล ถอนตัวออกจากการวิจัยเมื่อใดก็ได้ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้าและตัวข้าพเจ้าทั้งสิ้น จะไม่มีผลกระทบต่อการเรียนของเด็กในปกครองของท่านแต่ประการใด

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้า ตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆที่เกี่ยวข้องกับผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะนำเสนอข้อมูลจากการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้าและตัวข้าพเจ้า

หากข้าพเจ้าและผู้ที่อยู่ในความปกครองของข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย ข้าพเจ้าสามารถติดต่อกับ นางปณัสนันท์ กิติชัยเดชอนันต์ โทรศัพท์ 0842591665 ได้ตลอด 24 ชั่วโมง

มหาวิทยาลัยมหาสารคาม Mahasarakham University
Ethics Committee for Human Research
คณะกรรมการจริยธรรมการวิจัยในคน

ECMSU01-06.02

ข้าพเจ้าและผู้ที่อยู่ในปกครองของข้าพเจ้าเข้าใจข้อความในแบบคำชี้แจงอาสาสมัคร และแบบยินยอมนี้โดยตลอดแล้ว จึงลงลายมือชื่อไว้

ลงชื่อ.....อาสาสมัคร
(.....)
วันที่.....เดือน.....พ.ศ.....

ลงชื่อ.....ผู้ปกครอง
(.....)
วันที่.....เดือน.....พ.ศ.....

ลงชื่อ.....ผู้ให้ข้อมูลและขอความยินยอม
(.....)
วันที่.....เดือน.....พ.ศ.....

หมายเหตุ ในกรณีที่มีผู้มีส่วนร่วมในการวิจัยอายุระหว่าง 7-18 ปี ต้องลงนามให้ความยินยอมร่วมกับบิดา/มารดาหรือผู้ปกครอง (Assent)

มหาวิทยาลัยมหาสารคาม Mahasarakham University Ethics Committee for Human Research คณะกรรมการจริยธรรมการวิจัยในคน

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