European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejes.v9i7.4364 Volume 9 | Issue 7 | 2022

THE RELATIONSHIPS BETWEEN COGNITIVE AND METACOGNITIVE STRATEGIES AND EFL READING TEST PERFORMANCE OF THAI UNIVERSITY LEARNERS

Lingqing Zhang[1i],
Apisak Sukying[2]
[1]Master of English Language Teaching Program,
Faculty of Humanities and Social Sciences,
Mahasarakham University,
Thailand
[2]Department of Western Languages and Linguistics,
Faculty of Humanities and Social Sciences,
Mahasarakham University,
Thailand

Abstract:
This study investigated the relationship between cognitive and metacognitive strategy use and EFL reading test performance among EFL university learners in Thailand. One hundred ninety-nine non-English major students voluntarily participated in this cross-sectional research design. The five-point Likert Scale questionnaire was employed to collect learners' test-taking strategies after they had completed the EFL reading test. The semi-structured interview was then used to gather qualitative information from ten volunteers to better understand the strategy use during an EFL reading test. Descriptive and inferential statistics were applied to analyze the data. The results showed significant relationships between the applications of cognitive strategies and metacognitive strategy executions. However, the analysis of the results indicated no significant correlations between cognitive and metacognitive strategy use and reading test performance. Concerning qualitative data analyses, the results showed that learners' strategy use varied depending on test items. These findings could yield fruitful information for pedagogical practices, implications, and strategy training roles among university students. Detailed discussions in relation to pedagogy and further research are addressed.

Keywords: cognitive strategies, metacognitive strategies, reading test performance, Thai EFL learners

[i] Correspondence: email zhanglingqing23@126.com, 597288273@qq.com

1. Introduction

In language teaching, tests are regarded as an essential tool to measure the learner's ability (Cohen, 1984; Hughes, 2003). In language assessment, test-taking strategies are positively correlated with language-test performance and help respondents understand what they should do during reading tests (Huang, 2016; Phakiti, 2003; Zhang et al., 2014). Test-takers with high scores also use strategies significantly more often than test-takers with low scores (Lee, 2011). And teaching reading strategies via direct and integrated instruction of cognitive and metacognitive reading strategies contributed to learners' reading test scores (Du Plooy, 1996; Lee, 2011; Singhal, 1999). An L2 reading test is a means to infer a learner's L2 reading ability and identify methods to improve an individual learner's performance (Anderson, Bachman, Perkins, & Cohen, 1991; Cohen, 1994; Nikolov, 2006; Purpura, 1997). Test-takers need to perform as accurately and quickly as possible in a language testing situation, often under time pressure. Strategies used in L2 learning or SLA tasks may be distinct from those used in language tests. L2 test takers use strategies to solve problems, compensate for comprehension deficiency and enhance comprehension in the reading test (Pearson, 2009). In the L2 reading test domain, most empirical studies have examined the interaction between test takers' cognitive and metacognitive strategies and their performances on reading tests (Phakiti, 2003, 2008; Zhang et al., 2014; Zhang & Zhang, 2013).

Research on language testing (LT) has shown that test performance can be influenced by cognitive, metacognitive, and psychological factors. It has also been previously shown that test achievement can be improved by teaching subject-related test-taking strategies to the learners (Phakiti, 2003; Gray, 2011). Indeed, there are various factors that, together or individually, affect test performance.

To sum up, numerous studies have been conducted to find out the factors that affect the test performance of EFL learners. However, few studies have investigated the factors affecting their test performance in the Thai language context. The current study aimed to identify the test-taker's cognitive and metacognitive strategy use as a possible cause of variation in their reading test performance. Specifically, the study attempted to explore the type and frequency of test-taking strategies and their possible link to the EFL learners' performance on the reading test. This study provides new insights into the relationship between cognitive and metacognitive strategies in the Test of English for International Communications (TOEIC) reading test., especially in the Thai EFL setting. Insights gained from this study will help English teachers understand the role of cognitive and metacognitive strategies in improving reading test scores and provide references for future English teaching.

2. Literature review

English as a foreign language (EFL) reading is viewed as a complex, multifaceted cognitive skill. Moreover, reading is an interactive process between the text and the reader (Hudson, 1998; Psaltou-Joyce, 2010). In this context, successful comprehension occurs when the reader extracts and integrates information from the text with existing knowledge (Koda, 2005). While reading was once considered a simple receptive skill, it is now defined as a highly complex and interactive process in which readers use different resources to construct meaning from text (Grabe, 2009; Urquhart & Weir, 2014).

Reading has also been defined as a cognitive process that involves decoding symbols to acquire meaning and as an active process of constructing word meanings. In processing information, readers use strategies to understand what they are reading, use themes to organize their thoughts, and use text clues to discover the meaning of new words. Purposeful reading also helps readers target information to a goal and focuses their attention.

2.1 Language learner strategies

Language learner strategies are processes and actions that language learners intentionally use to help them learn or use the language more effectively. Language learning strategies (LLS) are conscious behaviors used by language learners to foster the acquisition, storage, and use of new information (Sukying, 2021). Language learning strategies include cognitive strategies (e.g., memory and recall skills) and metacognitive strategies (e.g., pre-planning, monitoring, and assessment of learning) that learners use when learning a language.

A trend has occurred in language testing research as researchers have expressed increasing interest in investigating test takers' cognitive characteristics that may influence language test performance (LTP). However, this theoretical interest in the cognitive processes of language learning, testing and use is not new. Only a handful of researchers have considered the extensive literature in learner strategies and cognitive psychology for inspiration in investigating cognitive processing's role in LTP. The interaction of L2 learner strategy studies, cognitive psychology, and testing research could significantly augment knowledge of cognitive processing and L2 ability.

2.1.1 Cognitive and metacognitive strategies

Cognitive strategies as direct language learning strategies are preferred to enable students to form and revise internal mental models and receive and produce messages in the target language in a conscious manner. These strategies help integrate old and new information and are indispensable tools in the learning process. According to Phakiti (2006), they are composed of three strategies: comprehending, memory, and retrieval. Besides these cognitive strategies, L2 learners also seem to use metacognitive strategies to understand a text. Cognitive theory suggests that all individuals can control language, but controlled processing places an additional burden on attentional processes. It

requires managing all stages of information processing with awareness of the purpose of learning a language. Thus, in addition to the operational cognitive processing function, the reading process contains executive or metacognitive functions.

Based on Phakiti (2006), metacognitive strategies consist of planning, monitoring, and evaluating strategies. The learners use these strategies to check or evaluate how well they have completed the task. Furthermore, metacognitive reading strategies stimulate one's thinking and enhance learners' academic performance (Anderson, 2002). Indeed, metacognition is essential in determining learning outcomes (Hattie, 2009; Veenman & Alexander, 2011) and plays a strategic role in constructing various assessment methods and tools. Thus, effective and efficient learners develop metacognitive skills that enable them to manage and utilize their learning.

Both these two strategies are involved in information processing activities. According to research on metacognitive and cognitive language learning strategies, the failure to transfer learning strategies to new tasks may be caused by a failure to integrate metacognitive information with cognitive strategies. In addition, research has shown that students without metacognitive strategies cannot review their progress, achievements, and future directions for learning (Alexander& Jetton, 2000; Pressley, 2000).

2.1.2 Reading strategies

Reading strategies are used to help learners solve reading problems (Yan & Cai, 2021; Pan, 2010; Zhang, 2004), and knowledge of learners' reading strategies aids the development of reading programs and also helps to improve reading levels and abilities (Shorey & Mohktari, 2001; William & Burden, 1997). Readers often use strategies to improve comprehension of a specific reading task (e.g., skipping raw words) via a conscious process (Birch, 2002). Research has also shown that readers with poor reading skills have less awareness of effective strategies and are less effective in reading monitoring activities. EFL learners who show evidence of metacognitive deficits may be unaware or incapable of monitoring their mental processes while reading. Nevertheless, unskilled learners can become skilled readers and whole-text learners if given effective strategy instruction and taught to use cognitive and metacognitive strategies to monitor and check their comprehension during reading (Carrell, Gajdusek & Wise; 1998; Iwai, 2011; Palincsar, 1986; Green & Oxford, 1995; Wernke et al., 2011).

2.1.3 Test-taking strategies

In recent years, many researchers have begun to focus on the role of test-taking strategies in validating language tests (e.g., Purpura, 1997; Rivers, 2001; Phakiti, 2003; Koda, 2007). This is due to the numerous test-wise strategies used by test takers to obtain correct answers without completely understanding the text, making the test results potentially misleading. Test-taking strategies are strategies used to respond to a test, which is not necessarily related to one's language ability. Thus, test-taking learners' strategies are instances of language use processes that respondents have chosen and of which they are at least somewhat aware (Cohen, 2007: 119). In general, most of the strategies selected by

test takers in language assessment are strategies they have learned in the language learning process. Cohen (1992) also noted that test-taking strategies represent processes that test-takers can control by choosing what they believe will help them answer the test questions, suggesting that test-taking strategies are conscious processes.

It is important to distinguish between test-taking and reading strategies because there is some overlap between them. First, test-taking strategies are not specific to any language skill, although each has some specific test strategies. Second, reading strategies are most used when readers are engaged in reading activities, which is why they are "*related to text comprehension*" (Singhal, 2001, p. 1). However, test-taking strategies are used only for tests or assessment tasks, which means that they are "*driven by test questions*" (Farr, Prichard, & Smitten, 1990, p. 218).

2.2 Previous studies on EFL reading test performance

Over the past few decades, several studies have attempted to understand the nature of L2 reading by investigating reader factors and contextual factors. Of these factors, the present study focuses on the nature of cognitive and metacognitive strategies and their relationships to EFL reading test performance.

In a recent study, Xia (2011) found that the total number of strategies used was unrelated to test performance, as unsuccessful students were observed to use more metacognitive strategies than successful students. By contrast, Kasimi (2012) investigated the frequency of using cognitive and metacognitive reading strategies among students with higher language proficiency and revealed the relationship between subjects' use of cognitive and metacognitive reading strategies. The results showed significant differences between groups in the frequency of using cognitive and metacognitive strategies. Ghafournia and Afghari (2013) further explored the interaction between cognitive test-taking strategies and reading strategies. The results showed that subjects with higher reading levels used cognitive test-taking strategies more than those with lower reading levels.

Zhu et al. (2021) explored the importance of metacognitive strategies and their correlation with English reading comprehension performance. The results showed that using metacognitive strategies positively correlated with reading performance. Non-English majors used metacognitive strategies extensively, but the frequency of use was generally not high. Sukying (2021) used a questionnaire to investigate the use of English language learning methods among Thai university students. The analysis showed that learning strategies are interrelated and that the use of learning strategies varies across academic clusters. And the use of learning strategies by Thai university students varies with individual differences and contextual factors. In addition, learners would benefit from training in the use of learning strategies.

3. Methodology

The current study seeks to find the answers to the following questions:

1) What are the patterns of strategy use in reading test performance among Thai non-English major students?
2) What is the relationship between cognitive and metacognitive strategies and reading test performance?

3.1 Participants

This study aimed to investigate the relationship between cognitive and metacognitive strategies and EFL reading test performance among 199 undergraduate students at a public university in northeastern Thailand. Participants were current undergraduate students at the university. All participants were 34 (17%) male and 165 (83%) female.

3.2 Instruments

Three instruments were used in the study to collect data. They were a TOEIC test, a cognitive-metacognitive strategy questionnaire, and an interview.

3.2.1 TOEIC Reading Test

The study adopted the reading section from the 2010 ETS Official TOEIC Test Preparation Guide and the reading section from the actual TOEIC test administered in Thailand in March 2021. The adopted section of this reading test has a total of 60 items. Test takers must select one of four possible responses to the questions in each text to answer the question correctly. Answers are determined by what is stated or implied in the text. Test-takers are tested on their ability to read and comprehend texts to answer the questions correctly in the Reading section. Participants had 60 minutes to complete these tasks.

3.2.2 Cognitive and Metacognitive Strategy Questionnaire

The items in the questionnaire were adopted from Phakiti (2006) on a 5-point Likert scale. As participants read the questionnaire items, they chose one of the following adverbs to indicate the frequency of each strategy used: 1 (never); 2 (sometimes); 3 (often); 4 (usually); and 5 (always). Phakiti (2006) reported that the questionnaire was construct validated. The total number of items in this questionnaire was equal for both strategy categories (26 items in total). The "past tense" was used since the questionnaire was administered after the students had completed the TOEIC test, and the "past tense" was used. The questionnaire was translated into Thai to help participants understand the questionnaire items. Time spent on the questionnaire is approximately 10-15 minutes. A description of the questionnaire's classification is provided in Table 1.

Table 1: Taxonomy of the strategy questionnaire

Processing	Subscale	No. of items	Items
Cognitive strategies	Comprehending	5	1, 2, 6, 8, 15
	Memory	4	4, 5, 9, 23
	Retrieval	4	7, 16, 17, 25
Metacognitive strategies	Planning	3	3, 12, 18
	Monitoring	5	11, 19, 21, 22, 26
	Evaluating	5	10, 13, 14, 20, 24
Total:		26	

3.2.3 Interview

After completing the reading test and questionnaire, 10 participants were randomly selected from 199 for the online interview. The interview includes introductory questions to reveal their performance in the reading test, with follow-up questions if necessary. The time for each interview is between 20 and 30 minutes. The interview was conducted in Thai and was transcribed verbatim and translated into English. All transcripts were then sent back to the interviewees for verification. The recording was transcribed for analysis. These names are anonymous. The data of this study were collected in the context of the COVID-19 epidemic, so the data from the TOEIC reading test questionnaire were collected through Google forms. Interview data were collected through ZOOM.

3.3 Data collection procedure

The participants took the TOEIC reading test and answered the cognitive and metacognitive strategy questionnaire. Before participating in all the projects, participants were introduced to the structure and purpose of the test and questionnaire, the purpose of the interview and the way to answer them. Finally, ten participants were selected for online interviews.

3.4 Data analysis

To probe the research questions, the data were analyzed by descriptive statistics, t-test, Pearson correlation analysis and effect size.

4. Results and Discussion

4.1 The use of cognitive and metacognitive strategies in Thai non-English major students

To address the first research question concerning the patterns of strategy use in reading test performance among Thai non-English major students, the descriptive statistics were calculated, the results of which are shown in Table 2.

Table 2: Descriptive statistics of cognitive and metacognitive strategies

Strategies	**Sub-strategies**	**Mean (%)**	**SD**
Cognitive	Comprehending	72.40	0.55
	Memory	73.80	0.61
	Retrieval	75.00	0.64
Total		**73.80**	**0.53**
Metacognitive	Planning	76.20	0.70
	Monitoring	73.60	0.59
	Evaluating	61.20	0.69
Total		**70.40**	**0.54**
Overall		**72.00**	**0.49**

As indicated in Table 2, Thai non-English majors are more likely to use cognitive strategies (73.80%) than metacognitive strategies (70.40%). The descriptive results confirmed that Thai EFL university learners reported using cognitive strategies more than metacognitive strategies, which is consistent with other studies using similar measures (Phakiti, 2003; Naeni & Rezaei, 2015; Sukying, 2021). This analysis revealed that, on average, Thai non-English major students were moderate users of cognitive and metacognitive strategies, and cognitive strategies were used more frequently than metacognitive strategies. The current results also indicate that Thai EFL University learners are not proficient in the use of metacognitive strategies.

A closer inspection of the cognitive strategy use subscale indicated that the retrieval strategy was reportedly used with the highest frequency (M=75.00%, SD=0.64). In comparison, comprehension strategies were reported to be the least frequently used (M=72.40%, SD=0.55). The results also showed that Thai EFL university learners most frequently reported using prior experience/knowledge to help them understand texts and to guess obscure words in texts by linking to context. This suggests that EFL learners tend to use comprehension and memory strategies to comprehend EFL texts. The participants may have failed to use comprehension strategies because the reading test texts used in this study were too difficult and, therefore, the test-takers could not understand the text content, which would also explain the test takers' low reading test performance.

The metacognitive strategies subscale inspection showed that planning strategies were used the most frequently (M=76.20%, SD=0.70), while evaluation strategies were the least commonly used (M=61.2%, SD=0.69). As the test takers worked through the tasks, they may have used these strategies to monitor their performance and update or modify their plans if necessary (Phakiti, 2006). Evaluating strategies may have been used to a lesser extent due to time constraints to complete the test. Participants may have rushed to complete the test and not had sufficient opportunity to evaluate their performance. In addition, the students' English proficiency may have been too low for the students to frequently use evaluating strategies.

To compares the use of cognitive and metacognitive strategies by Thai non-English majors' students, the results are indicated in Table 3. The mean scores on the use of cognitive and metacognitive strategies among Thai non-English majors were significantly different ($t = 5.54$, $p < 0.05$, Sig. 2-tailed = .000), as shown in Figure 1.

Table 3: Comparison of the cognitive and metacognitive strategies

Strategies	Mean (%)	N	SD	*t*	Dif.	Sig. (2-tailed)
Cognitive	73.80	199	0.53	5.54	198	.000
Metacognitive	70.40	199	0.54			

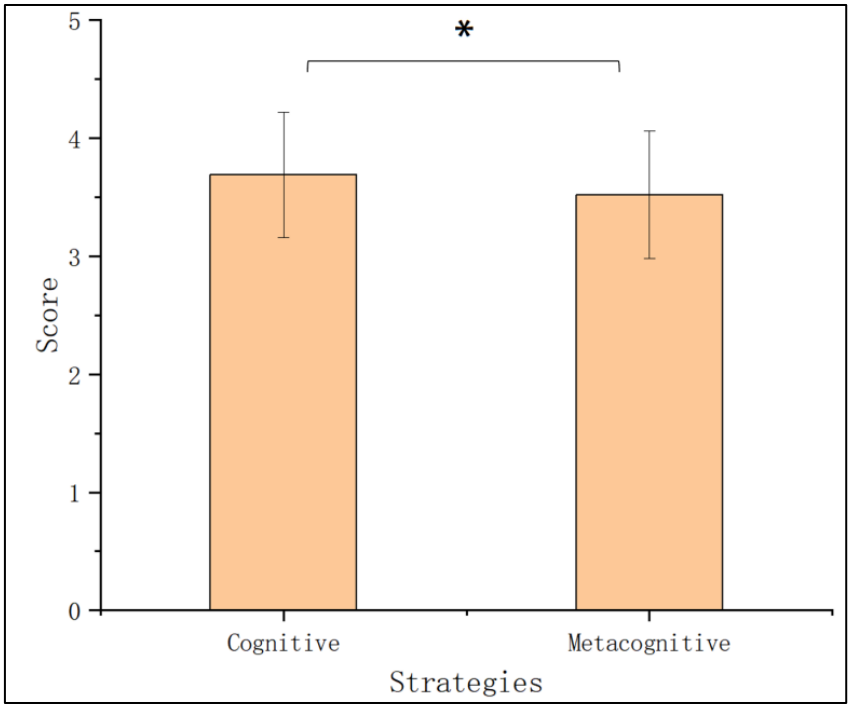

Figure 1: Difference between the use of cognitive and metacognitive strategies among Thai non-English major students

The qualitative data were analyzed and classified into themes based on Phakiti's (2006) cognitive and metacognitive model. The thematic content analysis revealed that it was difficult for participants to use metacognitive strategies separately from cognitive strategies. The interviewees reported that they tried to scan and skim to find the topic and main ideas (comprehension and memory strategies) and plan a course of action to answer the questions before answering (planning strategies). This indicates that planning enhances information storage indirectly rather than retrieval or comprehension. As such, the current findings suggest that planning strategies are essential for language test performance, even though they are not directly related to cognitive strategies. Comprehending and memory strategies influenced EFL reading test scores through retrieval strategies, and planning strategies affected EFL reading test performance by monitoring and evaluating strategies.

The quantitative data suggest that the use of cognitive and metacognitive strategies is inextricably linked, and the qualitative data indicated that all metacognitive and cognitive strategies had indirect positive effects on English reading test performance. That is, metacognitive strategies monitor and regulate actual cognitive behaviors for tackling specific test-taking tasks, eventually affecting test performance. This result is consistent with previous findings showing that metacognitive strategy use did not

directly influence test performance but affected it indirectly through cognitive strategy use (Phakiti, 2008; Purpura, 1999).

Consistent with previous studies (Oxford, 1990; Bachman & Palmer, 1996; Phakiti, 2003; Alderson, 2005; Chamot, 2005), the findings suggest that cognitive and metacognitive strategies are closely related. Specifically, cognitive strategies directly impact L2 performance as they involve the use of the target language. Indeed, cognitive strategies and metacognitive strategies influence each other, and the use of cognitive strategies has a direct impact on reading performance. In contrast, the use of metacognitive strategies affects the use of cognitive strategies, which in turn affects performance on reading tests. Although non-English majors in Thailand used cognitive strategies, the overall frequency of use was not high.

4.2 The relationship between cognitive and metacognitive strategy use and EFL reading performance

To probe the second research question: what is the relationship between cognitive and metacognitive strategies and reading test performance? The mean and standard deviation for the reading test performance among Thai non-English majors is shown in Table 4.

Table 4: A summary of reading test performance among Thai non-English majors

Variables	Mean (%)	SD
Reading test performance	23.06	6.72

As indicated in Table 4, the English proficiency of non-English majors in Thailand is relatively low (23.60%).

Pearson correlation index analysis was conducted, the results of which are indicated in Table 5. As shown in Table 5, the use of cognitive strategies was correlated with the use of cognitive strategies and metacognitive strategies ($r=0.6701$; $p < 0.01$). It was found that there was no significant correlation between reading performance and cognitive strategies ($p > 0.01$), and similarly, there was no significant correlation between reading performance and metacognitive strategies ($p > 0.01$). In the strategy use of Thai non-English majors, there is a significant correlation between the use of cognitive strategies and the use of metacognitive strategies.

The results showed a significant bidirectional correlation between the use of cognitive strategies and metacognitive strategies. This is consistent with previous studies on L2 English test takers' strategy use, showing that metacognitive strategy use has an executive function on cognitive strategy use (Phakiti, 2003; Purpura, 1999, 2008, 2016; Zhang & Zhang, 2013). The analysis also showed that cognitive and metacognitive strategies could predict EFL reading performance, and the conscious and appropriate use of strategies can help EFL learners achieve effective outcomes. However, distinguishing cognitive strategies from metacognitive strategies is difficult because they may overlap in some cases (Bax, 2013). That is, the same strategy can be viewed as either a cognitive

strategy or a metacognitive strategy, depending on the purpose for which the strategy is used.

Table 5: Pearson product-moment correlations between cognitive strategies and metacognitive strategies and reading test performance

		Metacognitive	Cognitive	Reading Test Performance
Cognitive	Pearson correlation	.6701***		.0176
	Sig. (2- tailed)	.0000		.8050
	N	199		199
Metacognitive	Pearson correlation		.6701***	-.0433
	Sig. (2- tailed)		.0000	.5435
	N		199	199
Reading Test Performance	Pearson correlation	-.0433	.0176	
	Sig. (2- tailed)	.5435	.8050	
	N	199	199	

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

Surprisingly, Pearson correlation analysis showed no statistically significant relationship between cognitive and metacognitive reading strategies and learners' reading performance, which is inconsistent with previous research (Kummin & Rahman, 2010; Kasimi, 2012; Naeni & Rezaei, 2015; Zarra-Nezhad, Shooshtari, & Vahdat, 2015; Zhu et al., 2021). Previous research has shown that participants perform better on reading tests when using metacognitive and cognitive strategies, and unfortunately, this did not happen in the current study. One possible explanation for this result is that participants probably over-reported their test-taking strategy use because they wanted to show that they understood it and that they already applied it while doing the reading test even though they did not use the strategies or use them but not very often. In the current study, although participants reported using cognitive and metacognitive strategies during reading, their reading test performance remained low-level. This may be due to respondents' tendency to rate themselves higher on questionnaires using cognitive and metacognitive strategies, with limited language skills, which negatively impacted their reading test performance. As Alsamadani (2009) mentioned in his research, awareness and use of metacognitive strategies do not guarantee satisfactory reading test performance. Many other factors still interact during the reading process that may affect the overall performance. This inconsistency may be explained by the participants' language ability and the difficulty of the exam. Indeed, Phakiti (2003) argued that cognitive and metacognitive strategies are weakly associated with reading performance due to the strong influence of other factors such as language ability and test method effectiveness. This result suggests that strategy use can explain a minority of test takers' performance on language tests (Phakiti, 2008; Song, 2005; Zhang et al., 2014).

As indicated in Table 6 that in the sub-strategies of cognitive strategies, there is a significant correlation between each sub-strategy. The correlation coefficient between comprehension strategies and memory strategies is 0.650 ($p<0.01$), which is significant at the 0.01 level. The correlation coefficient between the comprehension strategy and the

retrieval strategy was 0.680 ($p<0.01$), and the correlation coefficient between the memory strategy and the retrieval strategy was 0.679 ($p<0.01$), which was significant at the 0.01 level.

Table 6: Correlations between sub-strategies of cognitive strategy

		Comprehension	Memory	Retrieval
Comprehension	Pearson correlation		.650 **	.680**
	Sig. (2- tailed)		.000	.000
	N		199	199
Memory	Pearson correlation	.650**		.679**
	Sig. (2- tailed)	.000		.000
	N	199		199
Retrieval	Pearson correlation	.680**	.679**	
	Sig. (2- tailed)	.000	.000	
	N	199	199	

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

The results also showed that all cognitive strategies were highly correlated with each other, with retrieval strategies and comprehension strategies being the most strongly correlated and comprehension and memory strategies the weakliest correlated. The robust relationship between retrieval and comprehension strategies is likely because, in the Thai context, when they take the EFL reading test, they use their prior experience/knowledge (retrieval strategy) to help them understand English texts (Dawadi. S, 2017). The weaker relationship between comprehension and memory strategies might be due to EFL learners simply practicing comprehension strategies in class but not repeating them after class to consolidate their knowledge (Gonthier & Thomassin, 2015).

As indicated in Table 7, the correlations between each sub-strategy of the metacognitive strategy are analyzed. The results show that the correlation coefficients between the planning strategy, the monitoring strategy and the evaluation strategy are 0.505 and 0.450, respectively, and the correlation coefficient between the monitoring strategy and the evaluation strategy is 0.598, both of which are significant at the level of 0.01 ($p<0.01$).

Table 7: Correlations between sub-strategies of metacognitive strategy

		Planning	Monitoring	Evaluating
Planning	Pearson correlation		.505 **	.450**
	Sig. (2- tailed)		.000	.000
	N		199	199
Monitoring	Pearson correlation	.505**		.598**
	Sig. (2- tailed)	.000		.000
	N	199		199
Evaluating	Pearson correlation	.450**	.598**	
	Sig. (2- tailed)	.000	.000	
	N	199	199	

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

The current study found that, for metacognitive strategies, evaluating strategies and monitoring strategies were the most highly correlated. This indicates that the Thai EFL learners consciously monitor their own reading strategies and reading process during the reading process and adjust their reading strategies and methods (Zhang & Zhang, 2013; Liu, 2015; Dawadi. S, 2017). The correlation between planning and evaluating strategies was the weakest but was still moderate (r=0.450). This suggests that Thai EFL learners can make plans and arrangements, including setting goals, processes, and steps before reading. However, it also shows that most Thai EFL learners have not yet developed the habit of formulating writing plans and objectives, evaluating and reflecting on their own reading process, and performing self-assessments.

Table 8: Results of a pairwise comparison of cognitive and metacognitive strategies used by Thai non-English majors

Strategy	N	Mean	SD	t	Dif.	P-value	Effect size
Cognitive - Metacognitive	199	0.17	0.03	5.54	198	.000	.39

An effect size analysis was conducted; the results are shown in Table 8. Cohen (1988, 1992) provides guidelines for interpreting these values: the effect size is small if the value of r varies around 0.1, medium if r goes around 0.3 and large if r varies more than 0.5. As indicated in Table 8, Thai non-English majors employed a medium level of cognitive and metacognitive strategies on reading test performance (r=0.39).

5. Recommendations

The research has practical implications for classroom teaching. EFL teachers need to understand whether their students know different learning strategies and/or how effectively they use them. Teachers are also encouraged to allocate more time to teaching students how to apply cognitive and metacognitive strategies in order to improve students' reading test scores. In addition, research on conducting systematic and effective cognitive and metacognitive strategy training for Thai university EFL learners will substantially impact college English teaching outcomes.

It should also be noted that this study had some limitations that may have affected the results. For example, during the COVID-19 pandemic, the way data was collected limited the distribution of research. Furthermore, although test-takers report a high rate of use of available strategies, it is difficult to know whether they are using these strategies, which may affect the reliability of the questionnaire. Another limitation is the sample size of the current study, which was limited to 199 students from a public university in northeastern Thailand. This may limit the generalization of the results to other situations and contexts. Additional studies in this field using larger samples obtained from the same or similar populations or learning conditions are recommended to validate the current study's findings.

6. Conclusion

This study investigated the relationship between cognitive and metacognitive strategies and the EFL reading test performance of Thai EFL learners. In theory, as one of the few empirical studies to explore the role of strategy use in the Thai context, the results of this study provide some insightful information on the use of cognitive and metacognitive strategies. The current study revealed that Thai non-English major learners use cognitive strategies more than metacognitive ones. This study also showed no statistically significant relationship between cognitive and metacognitive strategies and reading test scores of Thai EFL learners. Still, cognitive and metacognitive strategies indirectly positively affected reading test performance. Therefore, it is reasonable to believe that informed training on the use of reading strategies can help EFL learners improve their reading skills and their overall English proficiency (Zhang & Wu, 2009).

Acknowledgements
The Authors would like to express their heartfelt thanks to Mahasharakan University in Thailand for its support of the research work and the cooperation of the participants in the study data collection.

Conflict of Interest Statement
The authors declare no conflicts of interest.

About the Authors
Lingqing Zhang is a postgraduate student in the English Language Teaching Program, Faculty of Humanities and Social Sciences, Mahasarakham University, Thailand.
Apisak Sukying works at the Department of Western Languages and Linguistics, Mahasarakham University, Thailand. His research interests include L2 vocabulary acquisition and development, vocabulary testing, SLA, ESP, academic writing and language learning strategies. His contact email is apisak.s@msu.ac.th.

References

Anderson, N. J. (2005). L2 learning strategies. In E. Hinkel, editor, Handbook of research in second language teaching and learning (pp. 757–771). Mahwah, NJ: Lawrence Erlbaum.

Bachman, L. F. & Palmer, A. S. (1996). Language testing in practice. Oxford: Oxford University Press.

Bax, S. (2013). The cognitive processing of candidates during reading tests: Evidence from eye-tracking. Language Testing, 30(4), 441-465.

Dawadi, S. (2017). Language learning strategies profiles of EFL learners in Nepal. European Journal of Educational and Social Sciences, 2(2), 42-55.

Koda, K. (2005). Insights into second language reading: A cross-linguistic approach. (1st ed.). Cambridge: Cambridge University Press.

Kummin, S., & Rahman, S. (2010). The relationship between the use of metacognitive strategies and achievement in English. Procedia – Social and Behavioral Sciences, 7, 145-150. http://dx.doi.org/10.1016/j.sbspro.2010.10.021

Naeini, M. B., & Rezaei, R. (2015). Examining and dealing with the issue of reading strategy use by Iranian EFL learners. The Reading Matrix: An International Online Journal, 15(2), 182-195.

Namsaeng, P., & Sukying, A. (2021). The Effect of Group Reading Strategy on Critical Thinking Skills in Thai EFL University Learners. *Journal of English Language Teaching and Applied Linguistics*, *3*(2), 30-40.

Phakiti, A. (2003b). A closer look at the relationship of cognitive and metacognitive strategy use to EFL reading comprehension test performance. Language Testing, 20, 26–56.

Phakiti, A. (2006). Modeling cognitive and metacognitive strategies and their relationships to EFL reading test performance. *Melbourne papers in language testing*, *11*(1), 53-94.

Phakiti, A. (2008). Construct validation of Bachman and Plamer's (1996) strategic competence model over time in EFL reading tests. Language Testing, 25, 237–272. https://doi.org/10.1177/0265532207086783.

Promluan, Y., & Sukying, A. (2021). *Enhancing Thai Primary School Students' Reading Strategies, Comprehension, and Vocabulary Knowledge through Reading* (Thesis, Mahasarakham University).

Psaltou-Joycey A. (2010). Language learning strategies in the foreign language classroom. (1st ed.). Thessaloniki: University Studio Press.

Purpura, J. E. (1999). Learner strategy use and performance on language tests: a structural equation modeling approach. Cambridge: University of Cambridge Local Examinations syndicate and Cambridge University press.

Scharnagl, T. (2004). The Effects of Test Taking Strategies on Students' Reading Achievement. Dissertations & theses, Union Institute and University Cincinnati, Ohio, Retrieved from ProQuest.

Sukying, A. (2021). Choices of Language Learning Strategies and English Proficiency of EFL University Learners. *LEARN Journal: Language Education and Acquisition Research Network*, *14*(2), 59-87.

Thiendathong, P., & Sukying, A. (2021). Vocabulary Learning Strategies Used by Thai High School Students in Science, Language, and English Programs. *Arab World English Journal (AWEJ) Volume*, *12*.

Tunaz, M., & Gülden, T. Ü. M. (2019). Test-taking strategies and students' achievement in EFL reading tests. *Journal of Language and Linguistic Studies*, *15*(1), 140-150.

Xia, Y. (2011). Efficient reading in standardized tests for EFL learners: a case study of reading strategies used by Chinese English major students in TEM-4. Retrieved in

March 20, 2014 from: http://www.diva-portal.org/smash/record.jsf?pid=diva2:429440

Zhu, X., Li, G. Y., Cheong, C. M., Yu, G., & Liao, X. (2021). Secondary school students' discourse synthesis performance on Chinese (L1) and English (L2) integrated writing assessments. *Reading and Writing*, *34*(1), 49-78.

Zhang, F., Wu, P., Huo, R. et al. (2009). Design and Implementation of Integrated Monitoring System for Meteorological Information Network Based on CS Structure. Meteorological and Environmental Sciences, 32, 279-282.

Zhang, L., & Zhang, J. L. (2013). Relationships between Chinese college test takers' strategy use and EFL reading test performance: A structural equation modeling approach. RELC Journal, 44(1), 35–37. https://doi.org/10.1177/0033688212463272.