A closer look at the relationship of cognitive and metacognitive strategy use to EFL reading achievement test performance

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Abstract

This article reports on an investigation into the relationship of test takers' use of cognitive and metacognitive strategies to the EFL reading test performance. The study employed both quantitative and qualitative data analyses. The 384 students enrolled in a fundamental English course at a Thai university took an 85-item, multiple-choice reading comprehension achievement test, followed by a cognitive-metacognitive questionnaire on how they thought while completing the test. Eight of these students (4 highly successful and 4 unsuccessful) were selected for retrospective interviews for further investigations of the nature of cognitive and metacognitive strategy use and its relationship to the test performance. The results suggested that (1) the use of cognitive and metacognitive strategies had a positive relationship to the reading test performance; (2) the underlying factor in the use of cognitive and metacognitive strategies could be metacognitive competence; and (3) highly successful students reported significantly higher metacognitive strategy use than moderately successful students

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who in turn reported higher use of these strategies than unsuccessful students. Discussion of the findings and implications for further research are articulated.

1. Introduction

Language testing (LT) research, one of the areas of inquiry in applied linguistics, has tended to concern itself with providing a model of language ability. Its primary aims are not only to describe and assess the language ability of an individual, but also to construct extensive theory of language test performance that describes and explains test performance variation and the correspondence between test performance and non-test language use. It is known that testing plays a significant role in influencing educational and social decisions about individuals (e.g. Bachman, 1990; Bachman and Palmer, 1996; Cohen, 1998b; McNamara, 1996; Messick, 1989), for example, its intended gate keeping function. The major issues concerning language test validity are the meaning, relevance and utility of test scores, the import or value implications of scores as a basis for action and the functional worth of scores in terms of the social consequences of their use (Messick, 1989). Validation research, accordingly, is essential to provide an understanding in the nature of language test performance.

In recent years, many LT researchers have been concerned with the identification and characterisation of individual characteristics that influence variation in performance on language tests. There are two types of systematic sources of variability (Bachman, 1990). These are, (1) variation due to differences across individuals in their communicative language ability (CLA), processing strategies and personal characteristics and (2) variation due to differences in the characteristics of the test method or test tasks. Test taker characteristics include *personal attributes* such as age, native language, culture, gender and background knowledge and *cognitive, psychological* and *social characteristics* such as strategy use, motivation, attitude, intelligence, anxiety and socio-economic status. Empirical investigations into the relationships between test taker characteristics and test performance cannot rigorously proceed without the theory of language ability. Since the 1970s, the extensive theory of second language (L2) ability has been posited (e.g. Bachman, 1990; Bachman and Palmer, 1996; Canale, 1983;

Canale and Swain, 1980; Hymes, 1972). Since the 1990s, a more unified model of language test performance has emerged (Kunnan, 1995). For the purpose of this article, models of language ability will not be discussed in detail. They have been treated extensively in McNamara (1996) and Purpura (1999). Bachman and Palmer's (1996) current model of language ability serves as a basic framework for the present study to examine two sets of factors, i.e. reading comprehension ability as CLA and cognitive and metacognitive strategy use as part of test taker characteristics. In their model, language knowledge, strategic competence and affect are demonstrated to interact with one another during language use. CLA is interacted with characteristics of language use contexts, test tasks and other mental schemata. Bachman and Palmer (1996) use metacognitive strategies as the definition of strategic competence which differs from the previous uses in Bachman (1990). Strategic competence is a link or mediator between the external situational context and the internal knowledge in communicative language use. In other words, strategic competence is conceived as higher order executive processing that provides a cognitive management function in language use and other cognitive activities.

In spite of the attempt to specify the model of communicative language ability, the current theory of strategic competence influencing L2 test performance seems to be in the early developmental stage. First, as pointed out by McNamara (1996: 75), the model proposed by Bachman and Palmer (1996) is only preliminary as such strategic use in their model touches on major topics in cognitive and social psychology and pragmatics. Second, the depiction of metacognitive strategies in their model is not based on empirical research (Purpura, 1999). Although Purpura (1999) has attempted to provide empirical investigations, some aspects of test taker characteristics such as strategy categories (e.g. learning strategies versus use strategies -- to be further discussed) and gender differences have been left out. Finally, since reading ability is part of CLA, the extent to which strategic competence interacts with L2 reading ability as measured by tests needs to be empirically investigated. In summary, despite the fact that LT researchers have become interested in the relationship of test takers' cognitive background characteristics (e.g. Cohen, 1994, 1998b; Kunnan, 1995; Nevo, 1989; Purpura, 1997, 1998, 1999), strategic competence on language test performance and variation on test scores have not been given sufficient attention (to be further discussed in *Review of*

Literature). Only a few researchers have pointed out and empirically investigated this issue (e.g. Purpura, 1997, 1998, 1999). In order to address some of these needs, the present study limits its investigation of test taker characteristics to the use of cognitive and metacognitive strategies in an English as a foreign language (EFL) reading comprehension test. Gender differences in the use of cognitive and metacognitive strategies in an EFL reading comprehension test will not be the focus in this article (See Phakiti, 2000; 2001).

2. Review of Literature

2.1 Language learner strategy

Learning strategies in SLA have emerged since the 1970s from a concern for identifying the characteristics of effective learners or good language learners (O'Malley and Chamot, 1990). SLA researchers, for example, have focused on investigating processes of how second language learners learn or what they do to arrive at successful or unsuccessful performance (Faerch and Kasper, 1983; Oxford, 1990; Rubin, 1975; Wenden, 1991). These SLA researchers propose a model that accounts for the cognitive factors of acquisition and performance. Learner strategies can be broadly divided into two types, i.e., *learning strategies* and *use strategies*. Learning strategies concern strategies language learners purposefully use to enhance their language learning and acquisition (SLA research), whereas use strategies are strategies they purposefully employ to enhance their performance, for example, to complete a language task, to communicate with others in the target language and to take a test (LT research). These two types of strategies share similar features or characteristics (e.g. cognitive and metacognitive). LT researchers tend to look at use strategies, rather than learning strategies when attempting to explain variation in a specific language test performance. Use strategies at the time the performance occurs may be suitably used to explain test score variation. The term 'strategy' seems to be defined in a number of different ways (see Purpura (1999: 22-37)). As pointed out by Cohen (1998b), there is a lack of consensus to argue and support whether strategies should be considered *conscious*. This issue is important for empirical research in order to arrive at proper descriptions of strategies. There are two issues that need to be addressed and made clear. First, in recent years, discussion of the role of consciousness in L2 learning suggests

terminology that may be useful to deal with this issue about strategy use. Language learning strategies can be stipulated either within the *focal attention* of learners or within their *peripheral attention* (i.e. learners can identify when asked immediately) (Schmidt, 1994). If the learners cannot identify any strategy associated with it as it is unconscious, the behaviour would simply be referred to as a process, not a strategy (Cohen, 1998b). Some researchers, such as Faerch and Kasper (1983), argue that once learners have developed some strategies to the point that they become automatic, those strategies maybe subconscious. Ellis (1994) argues that if strategies become automatic that the learners are no longer conscious of employing them and they cannot be accessible for description, they lose their significance as strategies. The approach in the present study to deal with use strategies concurs with Ellis's (1994), Cohen (1994, 1998b) and Schmidt's (1994). Although they discuss learning strategies, the same concept can be applied to strategies for use in language tests. In the present study, strategies are viewed as conscious and deliberate.

The second issue is whether a strategy is observable. Some researchers (e.g. Oxford, 1990) see strategies as observable whereas others (e.g. Purpura, 1999; Weinstein and Mayer, 1986) see them as both observable and unobservable. Purpura (1999) pointed out that a lack of observable behaviour does not necessarily entail a lack of mental processing. In this study, strategies are seen as both observable and unobservable. This assumption makes sense, especially for a quantitative research method where selected strategies are presented in a questionnaire for investigation. Selected strategies will be assumed to be observable, but it is essential for the researcher to allow for the possibility that the test takers might use a strategy provided in the questionnaire, but fail to report it. In other words, it may be wrong to imply that they did not use such a strategy. In validation research, it is important to employ multiple data gathering (e.g. combining qualitative data gathering, such as retrospective interviews to capture strategies that might be absent in the questionnaire, but appear to be used by test takers, with quantitative data). Further, human cognitive processes are composed of conscious and subconscious states (Gagné, Yekovich and Yekovich, 1993). In the present study, the overall cognitive strategy use is referred to as cognitive strategy processing, whereas the overall metacognitive strategy use is referred to as metacognitive

strategy processing. They are part of the conscious cognitive processing.

Many LT theorists (e.g. Alderson, 2000; Urquhart and Weir, 1998) have pointed out that the distinction among skills, strategies and processes are blurred in research practice. Many researchers use these three terms interchangeably (e.g. Cohen, 1998a, 1998b; Purpura, 1999). In this study, strategies are viewed as distinct from skills, especially in reading comprehension in that skills should refer to the largely subconscious nature of linguistic processes involved in reading (i.e. text-driven) while strategies should refer to purposeful and conscious cognitive processing (i.e. person-driven). This distinction follows Weir, Huizhong and Yan (2000). Nevertheless, as can be seen in the reading literature, many reading skills are ambiguously viewed as strategies. For example, what is the difference between inferencing skills and inferencing strategies? It is admitted that the absolute distinction between reading skills and reading strategies cannot be resolved in the present study.

2.2 Strategic competence

Metacognition and strategic competence are used interchangeably in Bachman and Palmer's model (1996) and by many LT theorists, for example, Alderson (2000), Douglas (2000) and Purpura (1999). In the present study, metacognition is looked also from the perspectives of cognitive and educational psychologists to help better understand strategic competence. The basic concept of metacognition is the notion of thinking about thinking (Hacker, 1998a). That is, thinking can be of what the person knows and what the person is currently doing. Metacognition is deliberate, planned, intentional, goal-directed and future oriented mental processing that can be used to accomplish cognitive tasks (Flavell, 1971). This cognitive processing involves active monitoring and consequent regulation and orchestration of cognitive processes to achieve cognitive goals. Monitoring, regulation and orchestration can be in the forms of checking, planning, selecting and inferring (Brown and Campione, 1977), self-interrogation and self-introspection (Brown, 1978), interpretation of the ongoing cognitive processes and/or simply making judgements about what one knows or does not know to accomplish a task (Baird, 1999; Hacker, 1998b).

Metacognition can also be conceived as composing of two facets, i.e. knowledge of cognition and regulation of cognition. Knowledge of cognition refers to what individuals know about their own cognition (Brown, 1978, 1987). This includes declarative (i.e. knowing about things or knowledge about oneself as a person and about other factors influencing performance), procedural (i.e. knowing how to do things) and conditional (i.e. knowing why and when to use declarative and procedural knowledge) (Schraw, 1998; Schraw, Dunkle, Bendixen and Bruning, 1995). Regulation of cognition refers to a set of activities that help individuals control their performance or learning. Three essential metacognitive strategies are planning, monitoring and evaluating. Kluwe (1982) further points out that metacognitive procedural knowledge consists of processes that monitor and regulate the selection, application and effects of solution processes to the problems. Executive monitoring processes (Kluwe, 1982: 212) involve metacognitive thinking that helps: (1) identify the task on which one is currently working; (2) check on the current progress of that work; (3) evaluate that progress; and (4) predict what the outcome of that progress will be. Executive regulation processes (Kluwe, 1982) are those directed at the regulations of the course of one's own thinking. They help: (1) allocate resources to the current task; (2) determine the order of steps to be taken to complete the task; and (3) set the intensity or the speed at which one should work on the task. Whether the persons can monitor and regulate their thinking and how well they can monitor and regulate that leads to successful opportunities depend on the task type, the task demands, their knowledge of the task and the kinds of cognitive strategies they can bring to bear on the task (Hacker, 1998a).

One of the most frequently discussed issues in metacognition that needs to be addressed here is: *Should thoughts once metacognitive that have become automatic through repeated use and overlearning still be called metacognitive?* This is an important issue which is related to how strategies have been defined in the present study. According to Ericsson and Simon (1993), since people (test takers) are likely to be only aware of the products of nonconscious automatic processes and not the processes themselves, it is difficult for them to report on these cognitive processes. As metacognition involves an awareness of oneself as an actor, a deliberate storer and retriever of information, it may be reasonable to "reserve" the term metacognitive for conscious and deliberate thoughts that have

other thoughts as their objects (Hacker, 1998a: 8). This perspective is beneficial for the research purpose in that not only can metacognitive thinking be perceived as potentially controllable by the test takers, but it can also be conceived as potentially reportable, thereby being accessible to the researcher. Due to our limited knowledge about the nature of metacognition, it makes sense not to perceive any *unconscious* and *automatic* thinking as metacognition because this causes ambiguity for research validity. In summary, despite the fact that researchers may not agree on some aspects of metacognition, a definition of metacognition at least should include the following notions (Hacker, 1998a: 11): knowledge of a person's knowledge, processes and cognitive states; and the ability to consciously and deliberately monitor and regulate the person's knowledge, processes and cognitive states.

The notion "strategic competence" is viewed as metacognition discussed above. That is, it refers to the conscious and deliberate ability to use any strategies (e.g. cognitive strategies and metacognitive strategies) necessary to appropriately complete a language task at hand. Cognitive strategies are likely to be encapsulated within language competence (e.g organisational and pragmatic knowledge) and world knowledge as extensively discussed in Bachman and Palmer (1996). Metacognitive strategies are higher order executive conscious and deliberate processes that provide a cognitive management function in cognitive strategy use to complete a language task. In the present study, examples of cognitive strategies are summarising, repetition, applying grammar rules, translation, making prediction, guessing meaning from contexts and using prior knowledge related to the task. Examples of metacognitive strategies are planning strategies (e.g. planning what to do before going into detail, time management and goal setting) and monitoring strategies (e.g. assessing situations, text comprehension monitoring, assessing ongoing performance, self-checking, self-evaluating). In the present study, goal setting is part of planning strategies while assessing situation, self-evaluation and self-testing are part of monitoring strategies.

2.3 L2 reading research

Reading research is of two broad categories: process-oriented and product-oriented (Weir, Huizhong and Yan, 2000). Process-oriented research aims at explaining the reading process (i.e. the

psycholinguistic process of reading). SLA research in reading comprehension is usually process-oriented since SLA researchers aim to look at how language learners learn and acquire L2 reading skills, thereby developing theories of L2 reading acquisition. On the other hand, product-oriented research aims to study the result of the reading process, thereby producing theories of reading performance. LT research in the past decades has largely used product-oriented approaches. Nevertheless, both SLA and LT researchers have recently viewed equal importance of both process- and product-oriented reading research. Their similar concern is a justifiable interpretation of reading performance via performance consistency (Bachman and Cohen, 1998; Chapelle, 1998). Understanding the process of reading is inevitably important in order to understand the nature of reading and hence, the nature of reading test performance. In this article, the perspectives of models of reading such as bottom-up, top-down and interactive processes will not be discussed. Alderson (2000) and Clapham (1996) provide excellent reviews of these reading models. It is noted that the top-down, bottom-up and interactive reading models might be too simplistic to explain the reading processes in parallel with various other theories of reading related to metacognition (see e.g. Graesser and Britton, 1996; Kintsch, 1993, 1998; Trabasso and Suh, 1993).

Studies in reading strategies bring together the assumption that individual characteristics may influence reading performance. Different readers may process the same text in different ways, depending on their purposes, attitudes, interests and background knowledge. Readers differ in the kinds and amounts of knowledge they have in relation to the topic being read. They differ in the way they reason about what has been read and in the kinds of inferences they may draw from their reasoning. Their goal of reading can be different. Meaning ascribed to the same words may differ from one reader to the next. In the current views of L2 reading, it is believed that much of what the readers do is the same as when they read in their first language (L1). However, L2 reading could be somewhat slower and less successful than L1 (Cohen, 1994), depending on factors such as the levels of readers' proficiency, types of text, text difficulty and task demands. Besides this, in understanding a text, they may encounter unknown words, an unfamiliar syntax of the text (e.g. complexity of sentences) and may not be able to use appropriate prior knowledge to help comprehend

the text. Alderson (2000) has treated the subject of variables affecting the nature of reading extensively.

According to Baker and Brown (1984), successful readers have an awareness and control of the cognitive activities they engage in as they read. Brown (1980) has shown significant examples of the metacognitive strategies involved in reading comprehension: (1) clarifying the purposes of reading; (2) identifying the important aspects of a message; (3) monitoring ongoing activities to determine whether comprehension is occurring; (4) engaging in self-questioning to determine whether goals are being achieved; and (5) taking corrective action when failures in comprehension are detected. Although the question of whether language proficiency leads to successful use of cognitive and metacognitive strategies remains unanswered, many empirical studies show that successful learners differ from less successful ones in both the quantity and quality of cognitive and metacognitive strategy use (e.g. Abraham and Vann, 1987; Chamot et al., 1989; Kaylani, 1996; Oxford, 1989a, 1989b; Politzer and McGroarty, 1985; Reiss 1983; Vann and Abraham, 1990). For instance, the literature on use of metacognitive strategies in reading comprehension reveals that poor readers in general lack effective metacognitive strategies (e.g. Alderson, 2000; Brown, 1989) and have little awareness on how to approach reading (e.g. Baker and Brown, 1984). They also have deficiencies in their use of metacognitive strategies to monitor their understanding of texts (e.g. Duffy et al., 1987; Pitts, 1983). In contrast, successful L2 readers know how to use appropriate strategies to enhance text comprehension (e.g. Chamot et al., 1989).

Language testers have begun to approach second language testing from the point of view of strategies used by test takers through the process of taking the test (e.g. Anderson, 1989; Anderson, Bachman, Perkins and Cohen, 1991; Cohen, 1984, 1994, 1998a; Dollerup, Glahn and Hansen, 1982; Nevo, 1989; Purpura, 1997, 1998, 1999). Traditionally, there is a different purpose between SLA elicitation tasks and language tests (Cohen, 1998a). In a language test situation, test takers need to perform as accurately and quickly as possible, often under time pressure. SLA tasks, on the other hand, are quite different from test tasks. SLA researchers normally encourage learners to take risks (usually with low anxiety as their performance would not have severe impacts on their lives) when learners do not have enough knowledge necessary for task

completion, so that the strategies they use can be determined. In a SLA task, learners can get scores for performance despite inaccuracies. Accordingly, strategies used in L2 learning or strategies elicited by SLA tasks can be assumed to be different from strategies used in language tests.

Early studies in test-taking strategies (e.g. Dollerup et al., 1982; Farr, Pritchard and Smitten, 1990; Nevo, 1989; some of those cited in Cohen, 1998b) are descriptive and small scale in nature. The major attempt was to identify and describe test-taking strategies. These studies seem to attempt to draw a distinction between what readers do in order to solve the test item problem (i.e. test-taking strategies) and what they might do in order to read a text (i.e. reading strategies or contributory strategies). Not surprisingly, many of these researchers (e.g. Dollerup et al., 1982; Nevo, 1989) conclude that some strategies are associated with test taking, some with reading strategies and some might be occurring in both situations. It is hence questioned whether some strategies associated with test taking should be considered part of the test construct (i.e. error of measurement or construct irrelevant (Messick, 1996)). There are limitations to be discussed in relation to these studies. First, it seems that the number of these strategies reflected is tied with test formats, for example, elimination is related to a multiple-choice test format. Second, those that are mentioned in these studies, except those involved in test format do not manifest with the range of reading strategies discovered in reading studies. For example, it is surprising that these studies did not mention such things as monitoring, evaluating or planning strategies, coherence-detecting strategies and using grammar. In other words, it may be concluded that these studies in test taking bear only a weak relationship to reading strategies reported by readers in a non-test situation (McDonough, 1995).

Until more recently, there have been studies looking at strategies test takers might employ when taking a test. Purpura (1997, 1998, 1999) quantitatively investigates the relationship between test takers' cognitive and metacognitive strategy use and performance on second language tests, using structural equation modeling (SEM) and exploratory factor analyses. The 1,382 subjects answered an 80-item cognitive and metacognitive strategy questionnaire before taking a 70-item standardised language test. The results indicate that cognitive strategies (i.e. comprehension, memory and retrieval

strategies) are directly and positively related to test performance. Metacognitive processing (MP) shows a significant, direct, positive relationship to all the three components of cognitive processing (CP) and is found to be indirectly related to test performance. Metacognitive strategies (i.e. assessing the situation, monitoring, self-evaluation and self-testing) are significantly correlated with each other. MP was found to exert an executive function—directing and controlling—over CP. Purpura also found that successful and unsuccessful performers invoke strategies differently. For example, the low performers showed an extremely high degree of metacognitive strategies in retrieving information from long-term memory, whereas the high performers use metacognitive strategies to help them understand and remember. Purpura points out that the amount of effort to use these strategies seems to depend upon the linguistic abilities needed to complete the tasks. In other words, test takers need a certain degree of language knowledge before they can make use of it. Although they might metacognitively know how to complete the task, but lack the linguistic features to complete the task, they might not be able to perform the task that well.

Purpura found that cognitive strategy use was a multi-dimensional construct consisting of a set of comprehending, memory and retrieval strategies. These cognitive strategies constitute a complex set of behaviours that work with one another to affect performance positively, negatively and neutrally. Metacognitive strategy use, on the other hand, was a unidimensional construct consisting of a single set of assessment processes (e.g. goal setting, planning, monitoring, self-evaluating and self-testing). For instance, when test takers set a goal, they assess what they want to do; when they plan what to do next, they assess the situation and assess which actions to pursue; and when they test themselves their knowledge or understanding, they assess what they think they know or understand. Purpura's findings on the nature of cognitive and metacognitive strategy use are helpful to conceptualise the distinction between metacognitive strategies and cognitive strategies and their functions as part of strategic competence as discussed previously.

In summary, having reviewed the literature in reading, language testing and other related areas, the present theoretical frameworks discussed seem to have important implications for the formulation of the strategic competence theory in L2 reading test performance. A comprehensive theory needs to take the following factors into

account: (1) the nature and magnitude of situational reading and use of strategic competence in a test situation; and (2) the measurement of the level of intensity of L2 reading ability and strategic competence evoked by a particular situation. The use of cognitive and metacognitive strategies may depend on the kind of test takers, the setting in which testing occurs and the kind of test tasks to be completed. This suggests a need for more research on different test takers in different settings. Few, if any, studies in the LT literature have looked at this relationship in an EFL achievement context. This lead to the following research questions:

1. What is the nature of cognitive and metacognitive strategies used in an EFL reading comprehension test?
2. What is their relationship to EFL reading comprehension test performance?
3. How do the highly successful, moderately successful and unsuccessful test takers differ in the use of cognitive and metacognitive strategies?

3. Method

3.1 Background and participants

The present study was carried out at Maejo University in Chiang Mai, Thailand. At the bachelor degree level, every student is required to study fundamental English courses in their first and second years of a four-year curriculum. The study used Fundamental English One (GE 140), in which reading comprehension skills are also emphasised in the assessment of students' achievement. The data was gathered during the final examination. There were 284 Thai students for quantitative data analyses (made up of 173 males (45 percent) and 211 females (55 percent)). There were 53 highly successful, 256 moderately successful and 75 unsuccessful test takers. Eight were selected for retrospective interviews (see *Structured retrospective interviews*). They were between the ages of 17 and 21 and had been studying English in Thailand for about eight years.

3.2 Measurement instruments

There were three main sets of research instruments employed in the study: (1) a reading comprehension achievement test (i.e. final

examination); (2) a cognitive-metacognitive questionnaire; and (3) structured retrospective interview questions.

3.2.1 Reading comprehension test

The following are examples of the objectives of the English course in teaching reading ability: (1) scanning and skimming text for general and specific information; (2) finding answers explicitly or implicitly to questions; recalling word meanings; (3) skimming to evaluate information; (4) guessing meanings of unknown words from context clues; (5) identifying phrases or word equivalence; (6) predicting topics of passages and the content of a passage from an introductory paragraph; (7) recognising abbreviations of words; (8) making decisions for appropriate information; (9) discriminating between more or less important ideas; (10) discriminating facts from opinions; (11) analysing reference words; (12) drawing inferences from the content; (13) identifying the title of the text and the appropriate heading; (14) summarising the content of the given text; and (15) finding the main ideas.

The multiple-choice test was developed and piloted for content and reliability analysis by the researcher and the teachers at Maejo University. The test consisted of two main sections: (1) reading comprehension tasks (e.g. several passages with various length of words and multiple-choice questions were given) and gap-filling cloze (e.g. several short passages with various types of words purposefully deleted and multiple-choices were provided). The test period was three hours. The reading comprehension test was analysed using the Rasch model of Item Response Theory (IRT) (e.g. McNamara, 1996) in the Quest Program (ACER, 1996) for internal consistency or reliability, item difficulty (i.e. the proportion of candidates getting an item correct) and person ability (i.e. the ability of the person based on the test construct). The IRT analysis result indicated approximate reliability of 0.88 (Part 1: 0.80, Part 2: 0.78) which was acceptable. The item difficulty and person ability map of the IRT model indicated a good match between the test taker's ability and the questions. For the purpose of this article, the nature of EFL reading comprehension measured by the achievement test will be excluded.

3.2.2 Cognitive and metacognitive questionnaire

The researcher developed a questionnaire to measure cognitive and metacognitive strategies applying relevant research instruments, for example, in O'Neil and Abedi, 1996; Oxford, 1990; Purdie and Oliver, 1999 and Purpura 1997, 1999. The criteria used to develop the questionnaire were based on: (1) theory of cognitive processing (e.g. the works of Gagné et al., 1993; Hacker, 1998b; Hasselhorn, 1995), metacognition and reading comprehension as discussed in the previous section; and (2) brevity (i.e. brief, precise and clear) which does not require too much time and effort to answer after the test. As part of the questionnaire development, the initial questionnaire was piloted with the participants during their midterm test and analysed for reliability before the actual use in the main study.

The categorisation of cognitive and metacognitive strategies was derived from the theory of reading comprehension and metacognition. In particular, items used to measure these strategies were identified as similar to those in Oxford (1990) and Purpura (1999), but adapted to suit the purpose and the context of the study. Cognitive strategies are viewed to be composed of: (1) comprehending/memory strategies (e.g. making predictions, translating; summarising, linking with prior knowledge or experience and repetition) and (2) retrieval strategies (e.g. applying grammar rules, guessing meaning from contexts and transferring prior knowledge). Metacognitive strategies are composed of: (1) planning strategies (e.g. planning what to do before going to detail, budgeting time to complete the tasks and identifying and clarifying the specific goals to achieve and how to achieve them); and (2) monitoring strategies (e.g. text comprehension monitoring, self-checking, evaluating ongoing performance and assessing comprehension in relation to tasks). Since the questionnaire was given after students had completed the test, "past tense" was used to express their thinking. The questionnaire was a 5-point Likert scale: 1 (Never), 2 (Sometimes), 3 (Often), 4 (Usually) and 5 (Always). The strategy use scale defines a continuum of increasing levels of intensity, i.e. low scores indicate a low frequency of strategy use and high scores indicate a high frequency of strategy use during the test completion. Table 1 presents a taxonomy of the questionnaire with the reliability estimates. Each variable was averaged by the number of items, for example, comprehending/memory strategies were divided by 6 to form the

composite variable. The purpose of dividing was to make a meaningful interpretation, i.e. 0 means 'never' whereas 5 means 'always'. Items 1, 3, 10, 11, 12, 13, 33 and 34 were excluded from the analyses (e.g. they decreased the item group reliability coefficients).

Table 1: A taxonomy of the cognitive-metacognitive strategy questionnaire

Processing	Sub-strategies		No. of items	Items used	Reliability
1. Cognitive strategy processing	Comprehending/ memory strategies		6	2, 5, 7, 8, 16, 24	.749
	Retrieval strategies		6	4, 6, 9, 20, 28, 32	.729
		Subtotal	*12*		.852
2. Metacognitive strategy processing	Planning strategies		8	17, 18, 21, 22, 25, 29, 30, 33	.840
	Monitoring strategies		7	14, 15, 19, 23, 26, 27, 31	.758
		Subtotal	*15*		.888
		Total	27		.930

3.3 Structured retrospective interviews

After the quantitative data were collected, qualitative data were additionally gathered to help further explain the nature of the use of cognitive and metacognitive strategies in the EFL reading comprehension test and the extent to which the highly successful test takers differed from the unsuccessful ones in this respect. The retrospective interviews were conducted with 8 test takers in Thai. The criteria used in the selection of interviewees were as follows: (1) an equal number of highly successful and unsuccessful groups determined from the final test performance; (2) an equal division of genders in each group; and (3) a willingness to participate in the interview session in which the students would also be asked to complete a 10-minute reading test. The interviewees were asked retrospectively about their thinking while they were completing the test tasks (both in the final examination and the short reading test). Their names were pseudonyms. The interviews were transcribed and translated into English. The transcripts were

double-checked for accuracy. The purpose of this analysis was to obtain the ideas (content) or trends of how the test takers used metacognitive and cognitive strategies in the reading test in the data based on the thematic framework as discussed in *Review of Literature.* The data were reduced using a coding system derived from the strategy typologies based on the substantive theories of reading comprehension, metacognition and emerging codes from data (See Phakiti, 2000). The codes here were not used as a measure of these strategies or to test hypotheses, but to discover themes or issues that might appear from the data set. After the transcripts were coded and rechecked for coding consistency, common patterns of metacognitive and cognitive strategy use were identified. For the purpose of this article, only two data display matrices (e.g. like those in Lynch, 1996; Miles and Huberman, 1994) will be presented.

3.4 Quantitative data analyses

In the quantitative data analysis, to determine its significance throughout the study, a 0.05 alpha ($p \leq 0.05$) was set, thus indicating that a result would be statistically significant if its likelihood of occurring by chance alone was less than or equal to five times out of 100. SPSS version 9 for PC (SPSS inc., 1999) was used to compute descriptive statistics and perform reliability analyses, Pearson product moment correlations, exploratory factor analyses (EFA) and factorial multivariate analysis of variance (MANOVA). In this article, Pearson product moment correlations will not be discussed (see e.g. Cohen (1988), Diekhoof (1992) for a nice introduction). This analysis was conducted to simply investigate the relationships between observed variables such as the relationships between strategies and their relationship to reading test performance.

An EFA was performed to examine a set of strategy variables to identify groups of variables that were relatively homogeneous, i.e. highly correlated. In other words, the aim was to determine whether the strategy items measured the same underlying strategies. It was performed on a matrix of Pearson product moment correlations (Diekhoof, 1992). This analysis demonstrated a collection of variables representing a number of underlying factors, i.e. cognitive and metacognitive strategy use. The present study used the Principal Axis Factoring (PAF) method. Three steps comprising the factor analytic procedure were: (1) computation of the correlation matrix; (2) factor extraction; and (3) rotation. As the

purpose of conducting an exploratory factor analysis was to reduce the number of factors, the EFA was based on: (1) Bartlett's test of sphericity (i.e. to test if the correlation matrix was identity); and (2) Kaiser's criterion (i.e. to select the factors that have an eigenvalue of greater than one to be extracted by performing a principal component factor analysis on correlations of the questionnaire items). The final stage included rotation, interpretation and labeling the underlying factors (to be further discussed in *Interpreting the Results*).

MANOVA procedures are multivariate extensions of the univariate analysis of variance (ANOVA). MANOVA includes the use of two or more dependent variables whereas ANOVA analyses only a single dependent variable at a time. Factorial MANOVA was used to compare groups of test takers exposed to two or more levels of independent variables called "factors". Factorial MANOVA can accomplish the task of examining the effects of independent variables (i.e. achievement levels and gender in this study) including both main and interaction effects on dependent variables (e.g. metacognitive strategy and cognitive strategy use). In this study, MANOVA was conducted to determine significant differences between highly successful, moderately successful and unsuccessful test takers in the use of metacognitive and cognitive strategies and their EFL reading test performance[1]. All assumptions for MANOVA were met, for example, univariate and multivariate normality, linearity, homogeneity of regression and homogeneity of variance-covariance matrices. The advantages of MANOVA are that not only does it provide tests of the effects of several independent variables and the effects of treatment combinations within a single analysis, but it also provides a more thorough test of significance than is available when using multiple univariate ANOVAs. In a related way, MANOVA reduces the likelihood of Type I and II errors (see

[1] In the present study, there were some criteria used to classify success levels among the test takers: (1) the likely grades (the standard of university grading system) they are likely to obtain from the test scores (e.g. A or B = high achievement, D or F = low achievement) (2) an expert judgement by the teachers (e.g. what scores they considered to be high achievement); and (3) the test analysis (e.g. standard error of measurement). For the purpose of the study, it was decided that students who obtained 70 percent or above, between 46 and 69 percent and below 45 percent of the test score were grouped as "highly successful", "moderately successful" and "unsuccessful", respectively. By using these criteria, a normal distribution in the particular groups was produced.

Diekhoof, 1992:130-131). MANOVA offers an interpretative advantage over a series of univariate ANOVAs. Discriminant functions used to examine an effect in a factorial MANOVA are orthogonal to each other (Diekhoof, 1992).

4. Interpreting the results

4.1 Descriptive statistics

Table 2 presents the distributions for the cognitive and metacognitive strategies. All the variables were normally distributed (i.e. skewness and kurtosis statistics were near zero (SPSS Inc, 1999).

Table 2: Distributions for the cognitive and metacognitive strategies

Item	Mean	Standard Deviation	Skewness	Kurtosis
Item 1	2.073	1.022	.680	-.172
Item 2	3.714	.989	-.443	-.405
Item 3	3.354	.969	-.327	-.380
Item 4	3.391	1.006	-.116	-.420
Item 5	3.638	.926	-.330	-.195
Item 6	3.958	.925	-.555	-.465
Item 7	3.302	1.016	-.076	-.461
Item 8	3.555	.965	-.217	-.479
Item 9	3.753	1.016	-.449	-.460
Item 10	2.945	1.145	.097	-.703
Item 11	2.935	1.234	.066	-.917
Item 12	2.484	1.045	.159	-.634
Item 13	3.068	1.103	-.217	-.588
Item 14	3.719	.858	-.274	-.169
Item 15	3.367	.947	-.124	-.325
Item 16	3.836	.859	-.348	-.395
Item 17	3.730	.876	-.288	-.253
Item 18	3.646	.967	-.252	-.448
Item 19	3.896	.925	-.488	-.427
Item 20	3.518	.894	-.132	-.233
Item 21	3.255	.884	-.043	-.147
Item 22	3.210	.862	-.385	.112
Item 23	3.576	1.004	-.489	-.123
Item 24	3.620	.909	-.118	-.593
Item 25	3.479	.882	-.155	-.90
Item 26	3.383	.844	-.034	.098
Item 27	3.352	.947	-.124	-.510
Item 28	3.354	.969	-.171	-.069
Item 29	3.354	.888	-.194	-.008
Item 30	3.654	.853	-.309	.123
Item 31	3.576	.925	-.292	-.329
Item 32	3.471	.882	-.177	.007
Item 33	3.810	.823	-.173	-.610
Item 34	3.831	1.050	-.501	-.676
Item 35	3.891	1.059	-.682	-.179

Table 3 presents the descriptive statistics of the test takers categorised by success.

4.2 Relationships between cognitive and metacognitive strategies and EFL reading performance

The Pearson product moment correlations demonstrated a positive relationship of cognitive strategies and metacognitive strategies to the reading test performance (i.e. r = .469 and .501, respectively). Cognitive strategies were correlated with metacognitive strategies (i.e. r = .823). Comprehending/memory strategies and retrieval strategies were correlated to each other (i.e. r = .746) while planning strategies were correlated with monitoring strategies (i.e. r = .762). In sum, it has been found that the use of cognitive and metacognitive strategies had a positive relationship to the EFL reading test performance. Further investigation of this relationship will be invested across different success groups of the test takers and in the qualitative data.

Table 3: Descriptive statistics by success

	Success	Mean	SD
EFL Reading Performance	Unsuccessful	32.415	3.937
	Moderately successful	47.957	5.167
	Highly successful	62.493	6.172
Comprehending/Memory strategies	Unsuccessful	3.041	.574
	Moderately successful	3.658	.581
	Highly successful	3.853	.586
Retrieval Strategies	Unsuccessful	3.129	.571
	Moderately successful	3.583	.581
	Highly successful	3.858	.607
Cognitive Strategy Processing	Unsuccessful	3.084	.539
	Moderately successful	3.620	.534
	Highly successful	3.856	.561
Planning Strategies	Unsuccessful	3.016	.487
	Moderately successful	3.504	.543
	Highly successful	3.910	.605
Monitoring Strategies	Unsuccessful	3.105	.501
	Moderately successful	3.551	.544
	Highly successful	3.872	.587
Metacognitive Strategy Processing	Unsuccessful	3.061	.446
	Moderately successful	3.528	.502
	Highly successful	3.891	.568

Unsuccessful test takers = 75
Moderately successful test takers = 256
Highly successful test takers = 53

4.3 Exploratory factor analysis

An examination of the correlation matrix indicates that a considerable number of correlations exceeded .3 and thus the matrix was suitable for factoring. The Bartlett test of sphericity was significant and that the Kaiser-Mayer-Olkin measure of sampling adequacy is greater than .6 (i.e. .938). An inspection of the Anti-Image correlation matrix reveals that all the Measures of sampling adequacy (MSA) were well above the acceptable level of .5. At the initial stage, five factors had eigenvalues greater than 1. If five factors were extracted, 53.534 percent of the variance would be explained. At the final stage, the eigenvalues of factors 3, 4 and 5 dropped below 1. Factors 1 and 2 explained 37.398 percent of the variance. The scree plot suggested that factor 1 was predominant. The factor matrix (a matrix of loadings or correlations between the variables and factors) showed that there were complex variables that had high loading (.3 or greater) on more than one factor (e.g. Items 5, 9, 21, 22, 27, 28, 29). Varimax rotation was therefore conducted to enhance interpretation. However, the rotated solution still had a few complex variables (e.g. Items 16, 17, 18, 19, 23, 24, 25, 26, 27, 29, 30, 33) that had high loading on more than one factor. Several cognitive strategy items were found to be loading with the same factor of other metacognitive strategy items.

In this regard, an oblique rotation (Direct Oblimin) was used as it might provide a more interpretable solution than that of the varimax rotation. The difference between high and low loadings was more apparent in the pattern matrix. At the initial stage, five factors were extracted, explaining 53.534 percent of the variance. However, at the final stage, the eigenvalues of factors 2 and 3 dropped below 1 while factors 4 and 5 disappeared. Factor 1 has an eigenvalue of 9.057 which explained 33.546 percent of the variance (see Table 4). Appendix B presents the result of EFA (Direct Oblimin). According to this result, a single solution might be appropriate in this analysis. The scree plot also confirmed the dominance of the single factor (see Appendix C). An examination of the items indicated that these items represented a conceptual aspect of metacognitive competence. Items loaded heavily on factor 1 measured metacognitive strategies (e.g. 17, 25, 30). Based on the Cronbach's alpha coefficient of the internal consistency as presented earlier (Table 1), the items comprising factor 1 produced a reliable scale. Given the strong relationship between cognitive strategies

and metacognitive strategies, it seems reasonable to conceive that cognitive and metacognitive strategy use might be the two facets of the same cognitive process (to be further discussed in the *Metadiscussion*). Because the primary purpose of conducting the factor analysis was to explore the underlying factor of strategy use, the factor solution that formed the one composite variable was not used for the subsequent analysis, i.e. the factorial MANOVA.

Table 4: Results of exploratory factor analysis

Factor	Description	Eigenvalue	% of Variance
1	Metacognitive competence	9.057	33.546

4.4 Factorial MANOVA

The Box's Test of Equality of Covariance Matrices demonstrated that the data had homogeneity of variance. Lavene's test of equality of error variances also indicated that the homogeneity of variance was not violated in the data set. The multivariate tests of significance, in particular Pillai's Trace criterion variance, the most robust statistic against violations of assumptions, indicated that there was a statistically significant multivariate effect for success levels ($F = 48.332$, $p < .05$). Accordingly, in the present study, the univariate F tests for the different groups could be interpreted. Table 5 presents the results of the factorial MANOVA. The tests of between-subjects effects showed that there was no interaction effect between the independent variables (i.e. success and gender) and the dependent variables. Therefore, the statistically significant differences found in the present study were due to the main effects only. The results showed that there was a statistically significant difference ($p < .05$) in the use of cognitive and metacognitive strategies among highly successful, moderately successful and unsuccessful students. In other words, highly successful students reported significantly higher use of comprehending/memory strategies, retrieval strategies, planning strategies and monitoring strategies than the moderately successful students who in turn reported more frequent use of these strategies than the unsuccessful. Figures 1 and 2 show the marginal means of cognitive and

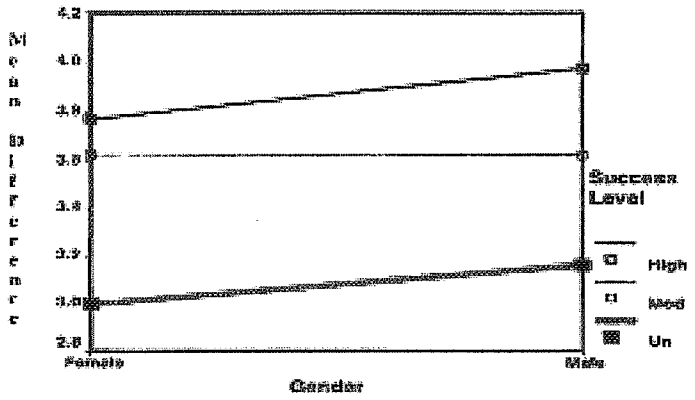
metacognitive strategy processing, respectively, between the three groups of success by gender[2].

Table 5: Factorial MANOVA results

Source	Dependent Variables	df	F	*P*
Success Levels	EFL Reading Test Performance	2	538.211	.000*
	Comprehending/Memory Strategies	2	33.533	.000*
	Retrieval Strategies	2	25.862	.000*
	Cognitive Strategy Processing	2	34.107	.000*
	Planning Strategies	2	45.451	.000*
	Monitoring Strategies	2	31.583	.000*
	Metacognitive Strategy Processing	2	44.377	.000*

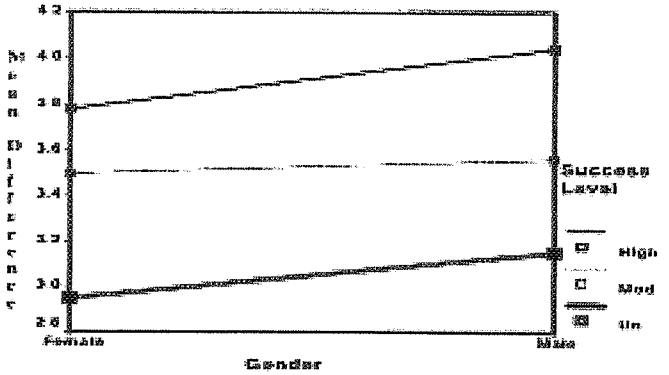
Scheffe post hoc tests (see Table 6) were conducted to point out which contrasts were different. The results showed that there were statistically significant differences in the use of cognitive and metacognitive strategies across the three groups, indicating that the highly successful test takers reported more use of these strategies than the other groups.

Figure 1: Estimated marginal means of cognitive strategy processing



[2] The following is a brief description of Figures 1 and 2. The figures demonstrate the estimated marginal means of cognitive and metacognitive strategy use respectively. The left of the figure represents mean scores of reported strategy use of females across levels of achievement (top-down: highly successful, moderately successful and unsuccessful). This explanation is the same to males on the right. Each line in the figure matches males and females of the same achievement level. Each line in the figure matches males and females of the same achievement level.

Figure 2: Estimated marginal means of metacognitive strategy processing



4.5 Qualitative data results

The qualitative data was analysed[3] in response to the quantitative finding that there was one factor underlying the use of cognitive and metacognitive strategies in the EFL reading comprehension test. The results demonstrated the interactive relationship between cognitive strategies and metacognitive strategies (see Table 7). Most cognitive strategies occurred in association with metacognitive strategies. Difficulties to separate metacognitive strategies from cognitive strategies were found in the qualitative data. For example, the distinction between repetition (cognitive strategy) and double-checking (metacognitive strategy) was not clear and their purpose of use varied across the test takers. Test takers need to be metacognitive to use cognitive strategies such as elaboration, inferencing and transferring.

[3] It might be important to note that the findings in the qualitative data are only suggestive due to the limited range of the interviewees and the period of time the data was gathered.

Table 6: *Scheffe post hoc* test of differences across the success groups

Dependent variable	(I) Success	(J) Success	Mean Differences (I-J)	Standard Error	*P*
EFL Reading Performance	High-suc	Mod-suc	14.511*	.677	.000
	High-suc	Unsuc	30.101*	.923	.000
	Mod-suc	Unsuc	15.590*	.774	.000
Comprehending/Memory Strategies	High-suc	Mod-suc	.212*	.077	.000
	High-suc	Unsuc	.831*	.105	.000
	Mod-suc	Unsuc	.619*	.088	.000
Retrieval Strategies	High-suc	Mod-suc	.289*	.077	.000
	High-suc	Unsuc	.756*	.105	.000
	Mod-suc	Unsuc	.467*	.088	.000
Cognitive strategy Processing	High-suc	Mod-suc	.251*	.072	.000
	High-suc	Unsuc	.794*	.097	.000
	Mod-suc	Unsuc	.543*	.082	.000
Planning Strategies	High-suc	Mod-suc	.422*	.072	.000
	High-suc	Unsuc	.932*	.098	.000
	Mod-suc	Unsuc	.509*	.082	.000
Monitoring Strategies	High-suc	Mod-suc	.334*	.073	.000
	High-suc	Unsuc	.786*	.099	.000
	Mod-suc	Unsuc	.452*	.083	.000
Metacognitive Strategy Processing	High-suc	Mod-suc	.378*	.067	.000
	High-suc	Unsuc	.859*	.091	.000
	Mod-suc	Unsuc	.481*	.077	.000

NB: This analysis was based on the observed means. * indicates that the mean difference was significant at the 0.05 level (95% confidence interval for mean differences).

From an identification of multiple occurrences among the interviewees in the qualitative data, the classifications of the phases in cognitive and metacognitive strategy use, i.e. before, during and after the action as proposed by Wenden (1991) were not apparent (See Table 8). The qualitative analysis suggested that metacognitive behaviour was *continua* (i.e. happened at all time), rather than discrete categories (Phakiti, 2000). For example,

similar cognitive and metacognitive strategy processing described as occurring *before* the test could appear to be used during the test. Metacognitive strategies seemed to be highly interactive among themselves and with cognitive strategies. In other words, cognitive and metacognitive strategy processing might be explained as a non-algorithmic system where thinking was not step-by-step. Particular strategies might be activated as needed only. The ability to know when certain strategies are needed may signify metacognitive competence. The qualitative data suggested that despite the fact that cognitive and metacognitive strategy use occurred as before, during and after the action as proposed by Wenden (1991), its use was more related to the behaviour than to the time of the behaviour (Purpura, 1999).

Table 7: Relationships of metacognitive and cognitive strategies to reading comprehension achievement

Relationships To Reading Test Performance	Examples
Metacognitive Strategies and Cognitive strategies	▪ I indicated the answer that could be translated (*translation – cognitive strategy*) and was most likely to be correct (*evaluation* – monitoring strategy) ▪ I read a passage and translated it into Thai (*selective attention* – planning strategy *& translation* – cognitive strategy). I translated it as reading (cognitive strategy) and judged if it made any sense and understandable (*comprehension monitoring* – monitoring strategy) ▪ I read the whole passage (*selective attention* – a monitoring strategy) and noticed whether it was understandable (*summarization* – cognitive strategy & *comprehension monitoring* – monitoring strategy); If yes, I went further to other parts of the passage (*performance evaluation* – monitoring strategy); second, read the questions to see what was asked (*comprehension monitoring* – monitoring strategy) and eliminated bad *choices (evaluating – monitoring strategy)* referring back to the passage (*repetition* (either a cognitive strategy or monitoring strategy) or *double-checking* – monitoring strategy using external standards with the text); finally selected the most suitable answer (*evaluation* – monitoring strategy) ▪ I read a passage quickly and determined the topic of the passage (*summarizing* – cognitive strategy & monitoring strategy) ▪ I used my prior knowledge or experience to help understand the passage or test (*Elaboration* – cognitive strategy)

For example, planning tends to be relatively abstract rather than concrete and complete. As the test takers worked through the tasks, they might need to update their plans based on metacognitive monitoring of how well their plans were working and when to modify such plans. Besides, when they completed the test, they

needed to keep track of what they had already done, what they were currently doing and what needed to be further completed. In this regard, serial models of cognitive and metacognitive strategy use (e.g. like in O'Malley et al., 1989; Wenden, 1991) might be appropriate only in a simple language task. These models might be problematic for the theoretical underpinning strategy-based conceptual framework in L2 reading comprehension, especially in a situation like testing where multiple sources of information is presented under time constraints.

Table 8: Phases of metacognitive strategy use

Phases	Examples
Before the test completion (Pre)	▪ I looked through all the test pages and noticed what they were about (*advance preparation or assessing situations* – planning strategy) ▪ I determined which parts or sections of the test were easy or difficult (*advance preparation* – planning strategy) ▪ I set time to complete for each part of the test (*time management – planning strategy*)
During the test completion (Online)	▪ I made a tick or mark on the answer sheet of the question I was not sure and later came back to consider/recheck the answer (*problem identification – integration of planning strategy and monitoring strategy*) ▪ I checked if what I understood from the passage made sense and understandable. This was usually done by translating, re-reading the passage and questions and sometimes using prior background knowledge about the topic (*comprehension check*—monitoring strategy) ▪ I checked whether the answer chosen was shown or implied in the passage (*double-checking or error monitoring* – monitoring strategy) ▪ I checked answers by substituting the selected answer with the sentence in the passage (*evaluating the performance* – monitoring strategy) ▪ I checked work while completing the test (*performance monitoring* – monitoring strategy)
After the test completion (Post)	▪ If I found I had chosen "10 Ds" continuously,I immediately rechecked the answers because something could be wrong (*performance evaluation* – monitoring strategy) ▪ I rechecked all the answers in terms of accuracy when I finished (*double checking* – monitoring strategy) the test tasks.

In addition to these matrices, the awareness of their thinking was qualitatively reflected by the successful test takers. No matter which strategies the highly successful test takers used, they tended to be aware of *how* and *why* they used a strategy to complete test tasks. The following qualitative data is from the highly successful students (Dara, female and Amnaj, male):

Dara: When I received the test, I first opened all the pages to see which parts or sections were easy or difficult. I would complete the easy ones first before attempting to finish the more difficult ones because I was not confident that I would have enough time to complete them all.

Amnaj: When I received the test, I first overviewed it. Second, I identified which parts of the test were easy and which parts were difficult. Then I started with the most difficult ones because when I first began doing the test, my brain was still fresh or not so tired. If I had finished the difficult one, say one section, if feeling tense, I would do an easy part. I continued this way interchangeably throughout the test.

The performance of these highly successful test takers seemed to result from their metacognitive competence of their mental states and current strategies employed. They knew which planning strategies, monitoring strategies and cognitive strategies worked best for them to complete the test tasks at hand. However, it might be worthwhile to carefully decide whether Dara's and Amnaj's metacognitive strategy processing to complete the test above that might positively influence their achievement in the test should be part of the test construct. In other words, should we consider these examples of their metacognitive strategy use related to the test construct and if not, should it be *error of measurement*? If it were, to what extent could we make inferences on their reading ability based on their test scores?

Despite the fact that the present study did not focus on affect, these qualitative examples clearly show that metacognitive competence links affective states to ease pressure and therefore enhance the test performance. For example, Dara reflected on her use of metacognitive strategies because she was aware of the time constraint in the test ("I was not confident..."). Amnaj's metacognitive strategy use might be derived from his realisation that he might "get tense" during the test. Given the possibility that different test takers had different emotional responses to the test, understanding the relationship of cognitive and metacognitive strategies to their affective states may be beneficial in L2 reading assessment. This finding opens room for future LT research.

5. Metadiscussion

The study has demonstrated the relationship of metacognitive and cognitive strategies to reading comprehension test performance, the

nature of the cognitive and metacognitive strategy processing captured from both quantitative and qualitative data analyses and the differences in the use of cognitive and metacognitive strategies across the achievement groups. There seem to be complicated levels to this mental processing. Cognitive and metacognitive strategies might need to be viewed as the two interactive facets of strategic competence that do not occur independently from each other. As pointed out by Purpura (1999: 127), "cognitive strategy use seems to function in concert with metacognitive strategy use, which functions in an executive capacity". For example, summarising the main idea of the text would not be effective if the act of monitoring and evaluating it were completely divorced; translating some parts of the text would be useless if the act of checking whether meaning made sense (comprehension monitoring and self-evaluating) in relation to the internal and external standards of the text were absent. This position does not necessarily mean that these dimensions must have a symmetrical influence on test takers' behaviour in a given situation. For example, test takers might have a high degree of cognitive strategy use, but take no action to plan and monitor its use. In addition, examples from the qualitative data show that it is difficult to argue that a strategy categorised as cognitive is not metacognitive. For example, in translation, the more the test takers attempt to translate a text (engaging with repetition -- a cognitive strategy), the more they are engaged in higher degrees of metacognitive strategy processing. Another instance is the distinction between repetition (a cognitive strategy) and double-checking (a metacognitive strategy). Perhaps, the *goal* of using a strategy determines whether it is cognitive and metacognitive. Adapting from Flavell (1992), if test takers read a passage because they have to demonstrate their ability to comprehend the texts via test questions (a cognitive goal), they might be using a cognitive strategy. If they read a passage because they wonder if the text is well understood or if the task requirement (e.g. identifying the correct answer) has successfully been reached (a metacognitive goal) by referring back and forth to the text and questions, they might be using a metacognitive strategy (assessing and evaluating his/her own knowledge/performance). However, these examples still do not make such a distinction clear because cognitive-metacognitive goals form a continuum, rather than discrete categories.

Evidence from the present study might suggest that the nature of metacognitive strategies and cognitive strategies may be

multidimensional in their own right, but they might be located underneath a *unidimensional* construct of metacognitive competence. At this stage, it is quite apparent that using the definition of a set of metacognitive strategies to explain the nature of "strategic competence" might be theoretically misleading. This conception might limit our understanding of the notion of strategic competence to strategies only. The bulk of the literature on metacognition and reading comprehension along with the findings in this study suggest metacognitive strategies are only part of metacognitive competence. It is admitted that researchers other than in SLA and LT fields are also confused and not clear about the term as they often use it in an ambiguous way. As we have termed "strategic competence" to explain a component of CLA in a broader sense than just a set of metacognitive strategies, for instance, we include conscious awareness of test takers' thinking as a component of strategic competence, we may then need to consider another term to better represent this notion. If strategic competence is a reflection of metacognition, *"metacognitive competence"* might be a better term. The proposed term is not only more straightforward than strategic competence, but also covers the whole notion of metacognition. In addition, metacognitive competence would include both cognitive and metacognitive strategies as its facets. Individuals (test takers) who are metacognitively competent are more likely to understand how the strategies fit together and how they fit to the language tasks than those with little of this competence. Future research should address the need for a better definition of metacognitive competence in language test performance.

It is worth noting that given the notions of variation in LT research that reflect the interactionalist perspective (e.g. Chapelle, 1998) of L2 performance, it is vital that the terms "state" and "trait" are discussed. It appears that to date, SLA and LT researchers have not made a clear distinction between state and trait notions when investigating metacognitive and cognitive strategy constructs. The state-trait constructs originated from anxiety theory (Spielberger, 1972, 1975, 1983). States and traits refer to two different classes of psychological attributes for describing persons (e.g. Hong, 1998a, 1998b; O'Neil and Abedi, 1996). It is believed that each individual has (1) a transitory state and (2) a relatively stable trait (Hong, 1998b). States are situation specific and are considered to vary in intensity and change over time because the level of activities changes from situation to situation. Traits are, on the other hand,

considered relatively enduring predispositions or characteristics. For example, state metacognitive strategies are a transitory state of the test takers in an intellectual situation that varies in intensity and changes over time, whereas trait metacognitive strategies are considered a relatively stable individual difference variable to respond to intellectual situations with varying degrees of state metacognitive strategies. In other words, trait metacognitive strategies could be assumed to influence the way state metacognitive strategies are used in a specific situation. As pointed out earlier, it is the context that may affect their reading test performance and use of cognitive and metacognitive strategies. Their performance and the cognitive-metacognitive strategy processing in a specific situation should be viewed as a *state* rather than a *trait*. The present study theoretically and methodologically investigated *state* cognitive and metacognitive strategy use (refer to the *Method*). The test takers were asked to indicate how they used cognitive and metacognitive strategies during the reading test. To simplify this, how the test takers are thinking when completing a language test (i.e. states) seems more related to their specific test performance than what they think they do when completing a language test (see Purpura, 1999 for trait strategy items in which the present simple tense is used). Chapelle (1998:65) points out that task analysis investigating the strategies used in an operational setting forces researchers to recognise what Messick (1989) defines as the "conundrum of educational measurement" -- that strategies can vary across people and tasks, even when the same results are achieved. Understanding the nature of operational settings across which consistent performance can be observed is essential in order to make further substantive progress to understanding the construct definition of the interactionalists (e.g. Chapelle, 1998).

6. Concluding remarks

The present study aimed at investigating the nature of cognitive and metacognitive strategies in relation to EFL reading test performance. This study was motivated by the assumption that variability in language test performance can be attributed to test taker characteristics (e.g. Bachman, 1990). The findings of the study suggest that metacognitive competence could explain variation on language test performance. The use of cognitive and metacognitive strategies across the achievement groups (highly successful, moderately successful and unsuccessful groups) differed

quantitatively and qualitatively. Given the nature of the cognitive and metacognitive constructs involved and a number of possible interactions among strategies in this operational setting and the data gathering methods and analyses, it needs to be acknowledged that the relationship of metacognitive competence to EFL reading performance could be far more complicated that what has been found. In addition, the nature of metacognitive competence found in the present study is not comprehensive as the study excluded other factors such as affect (e.g. motivation and volition) that are believed to affect not only language test performance, but also the use of cognitive and metacognitive strategies. It is also noted that the types of cognitive and metacognitive strategies in the study were only some of the possible strategies EFL students might have used during the reading test. One might argue that the results of the study might be limited by the limitation of the research instruments (i.e. questionnaires and the multiple-choice test method) (see e.g. Nunan, 1992; Purpura, 1999 for strengths and weaknesses of self reported strategy use elicited by questionnaires; and Alderson, 2000; McDonough, 1995 and Weir, 1990 for multiple-choice test methods). However, based on the substantive theory of metacognitive competence in cognitive, social and educational psychology, second language acquisition, educational measurement and language testing research, the carefully designed research methods and the number of the participants in the study, it is hoped the potential threats to research reliability and validity were minimised.

This study has opened further areas of investigation into the relationship of metacognitive strategies and cognitive strategies in second/foreign language testing. Given the assumption that state metacognitive competence in an operational test setting changes over time, the construct definition inquiry process is to observe the consistency of test takers' performance and their use of metacognitive competence in various test method facets. Replication of the present study is recommended mainly in the hope that performance consistency in the use of cognitive and metacognitive strategies can be observed, not just to find out 'the extent to which the findings in the study would be the same or different in other contexts such as English as a second language (ESL) or foreign languages other than English'. Giving the same test to the same test takers might even show that they did not use the strategies the same way they did this test. The findings in the present study might be related to the type of tests (i.e. multiple-choice) and the

types of texts and tasks presented. Effects of test methods and text difficulty on cognitive and metacognitive strategy use at various English proficiency levels should then be explored since levels of reading text difficulty and task demands could result in different processing of metacognitive and cognitive strategies. More research emphasising differentiating *state* from *trait* cognitive and metacognitive strategy use and their significant relationship to specific L2 testing performance is needed in order to unlock the strategy performance door. The degree of stability over time might help distinguish the conceptual nature of trait and state constructs. That is, it is logical to assume that traits should be more stable than states (e.g. Hong, 1998b) and that states should be more related to a specific test performance than traits. Future LT research needs to address these two notions as construct validity evidence. The extent to which the use of cognitive and metacognitive strategies in a reading comprehension test is the same as that in non-test reading comprehension needs to be identified in order to make inferences or claims about actual reading ability measured and to identify whether some metacognitive strategies should be considered a source of measurement error. In addition, this study has shown that although the sample size was small, qualitative data illustrates test takers' behaviour, i.e. how and why they use metacognitive strategies to regulate cognitive strategies. Other issues underlying the use of strategies may emerge from the qualitative data such as affect as previously discussed. It is therefore recommended that future research combine quantitative and qualitative data gathering and analysis methods to understand the nature of strategy use in L2 reading performance.

To conclude, it is hoped that the present study has not only helped make a contribution to a more comprehensive theory of L2 reading test performance in which the use of state cognitive and metacognitive strategies, namely metacognitive competence, plays a significant role, but has also offered some possible ways of looking at theoretical and methodological perspectives for assessing cognitive and metacognitive strategy processing. It is hoped that the lid of the Pandora's Box (see McNamara, 1996) has been lifted and some of its contents have been investigated in the present study.

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Appendices

Appendix A: Cognitive and metacognitive questionnaire

Directions: A number of statements which people use to describe themselves when they were taking a test are given below. Read each statement and indicate how you thought during the test. Choose 1 (Never), 2 (Sometimes), 3 (Often), 4 (Usually), and 5 (Always).

	Your thinking	1	2	3	4	5
1.	I made short notes or underlined main ideas during the test.	1	2	3	4	5
2.	I translated some parts of the reading texts and tasks into Thai.	1	2	3	4	5
3.	I used pictures or titles of the texts to help comprehend reading tasks.	1	2	3	4	5
4.	I used my own English structure knowledge.to comprehend the text.	1	2	3	4	5
5.	I spent more time on difficult questions.	1	2	3	4	5
6.	I tried to understand the texts and questions regardless of my vocabulary knowledge.	1	2	3	4	5
7.	I tried to find topics and main ideas using scanning and skimming techniques of reading comprehension.	1	2	3	4	5
8.	I read the texts and questions several times to better understand them.	1	2	3	4	5
9.	I used my prior knowledge to help complete the test.	1	2	3	4	5
10.	I tried to identify easy and difficult test components before completing the test.	1	2	3	4	5
11.	I looked at the scores of each part to determine the weight of scores before starting to complete the test.	1	2	3	4	5
12.	I determined which parts were more important than others before starting the test.	1	2	3	4	5
13.	When I started to complete the test, I planned how to complete the test and followed the plan.	1	2	3	4	5
14.	I was aware of my thinking process (what and how I was doing) to complete test tasks.	1	2	3	4	5
15.	I checked my own performance and progress while completing the test.	1	2	3	4	5
16.	I attempted to identify main points of the given reading texts and tasks.	1	2	3	4	5
17.	I thought through the meaning of the test tasks/questions before answering them.	1	2	3	4	5
18.	I was aware of which thinking technique or strategy to use, how and when to use it .	1	2	3	4	5
19.	I corrected mistakes immediately when found.	1	2	3	4	5
20.	I asked myself how the test tasks/questions and the given texts related to what I already knew.	1	2	3	4	5
21.	I determined what the test tasks/questions required me to do.	1	2	3	4	5
22.	I was aware of the need to plan a course of action and to monitor whether it effectively worked to help me complete	1	2	3	4	5

	the test.					
23.	I was aware of how much the test remained to be completed.	1	2	3	4	5
24.	I tried to understand the tasks/questions adequately before attempting to find the answer.	1	2	3	4	5
25.	I made sure I understood what had to be done and how to do it.	1	2	3	4	5
26.	I was aware of my ongoing thinking process that helped me fulfil the tasks.	1	2	3	4	5
27.	I kept track of my own progress to complete the questions on time.	1	2	3	4	5
28.	I used multiple thinking strategies to help answer the test questions.	1	2	3	4	5
29.	I made sure to clarify the goal and know how to complete it.	1	2	3	4	5
30.	I was aware of my own attempts and selected strategies to help me understand the test questions before solving them.	1	2	3	4	5
31.	I checked my accuracy as I progressed through the test.	1	2	3	4	5
32.	I selected and organised relevant information to help me understand the reading texts and answer the test questions correctly.	1	2	3	4	5
33.	I determined how to solve the test questions and was ready to change it when it did not work.	1	2	3	4	5
34.	I carefully checked the answers before submitting the test.	1	2	3	4	5
35.	I thought about how I had completed the test and how I could do it better next time.	1	2	3	4	5

Appendix B: Results of EFA for cognitive-metacognitive strategies (Direct Oblimin)

Items	Factor		
	1	2	3
17	.707		
30	.683		
25	.667		
32	.661		
24	.659		
26	.657		
16	.646		
33	.630		
31	.601		
21	.592		
18	.588		
9	.573	.397	
6	.568	.334	
22	.563		-.338
29	.561		.314
5	.554		
15	.552		
28	.542		
20	.532		
14	.530		
7	.525		
8	.522		
19	.518		
4	.509		
23	.491		
2	.453		
27	.447		

Appendix C Scree plot of an exploratory factor analysis