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

Aek Phakiti *The University of Melbourne*

This article reports on an investigation into the relationship of test-takers' use of cognitive and metacognitive strategies to the EFL (English as a foreign language) 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. The results suggested that (1) the use of cognitive and metacognitive strategies had a positive relationship to the reading test performance; and (2) highly successful test-takers reported significantly higher metacognitive strategy use than the moderately successful ones who in turn reported higher use of these strategies than the unsuccessful test-takers. Discussion of the findings and implications for further research are articulated.

I Introduction

Language testing (LT) research 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 an extensive theory of language test performance that describes and explains test performance variation and the correspondence between test performance and nontest language use. In recent years, many LT researchers have been concerned with the identification and characterization of individual characteristics that influence variation in performance on language tests. There are two types of systematic sources of variability (Bachman, 1990):

Address for correspondence: Aek Phakiti, Department of Linguistics and Applied Linguistics, The University of Melbourne, Victoria 3010, Australia; email: a.phakiti@pgrad.unimelb.edu.au

Language Testing 2003 20 (1) 26–56 10.1191/0265532203lt243oa

- variation due to differences across individuals in their communicative language ability (CLA), processing strategies and personal characteristics; and
- 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. 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., English 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 interacts 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 mediator between the external situational context and the internal knowledge in communicative language use.

Despite the attempt to specify the model of CLA, the current theory of strategic competence influencing second language (L2) test performance remains in the early developmental stage. McNamara (1996: 75) points out that 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. The depiction of metacognitive strategies in their model is also not based on empirical research (Purpura, 1999). Only a few researchers have empirically investigated this issue (e.g., Purpura, 1997; 1998; 1999). Accordingly, validation research on the relationship of strategic competence on language test performance is needed.

II Review of the literature

1 Language learner strategy

Learner strategies can be broadly divided into two types, i.e., learning strategies and use strategies. Strategies that language learners purposefully use to enhance their language learning and acquisition are learning strategies, whereas strategies they purposefully employ to

enhance their performance (e.g., to complete a language task, to communicate with others in the target language and to take a test) are use strategies. Learning strategies are ongoing and continuous in nature, whereas use strategies are associated with a specific situation. For example, the statement 'when I speak English, I usually know when I make grammar mistakes' is considered a learning strategy. This strategy seems to happen at all times and it helps the learner acquire the language. The statements 'when I spoke English during the job interview this morning, I usually knew when I made grammar mistakes. I corrected them immediately' would be considered a use strategy, rather than a learning strategy. These two types of strategies share similar features or characteristics (e.g., cognitive and metacognitive). Prior to a testing situation, learning strategies help learners acquire language knowledge or vice versa and store it in long-term memory. In a test or target language use (TLU) situation, strategy use is related to the ongoing working memory in association with the short-term memory regarding TLU to retrieve necessary declarative (knowing what), procedural (knowing how) and conditional (knowing when) knowledge in the long-term memory to solve task difficulty (Gagné *et al.* 1993).

LT researchers tend to look at use strategies rather than learning strategies when attempting to explain variation in a specific language test performance because strategies used at the time the performance occurs are directly related to the test score variation. Admittedly, there is some controversy concerning the definition of strategies. In recent years, discussion of the role of consciousness in L2 learning suggests terminology that may be useful to deal with the definition of strategy use. 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, then the behaviour would simply be referred to as a common 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 may be subconscious. Ellis (1994) argues that if strategies become so 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), Schmidt's (1994) and Cohen's (1998b).

Some researchers (e.g., Oxford, 1990) see strategies as observable, but others (e.g., Weinstein and Mayer, 1986; Purpura, 1999) see them as both observable and unobservable. Purpura (1999) points out that

a lack of observable behaviour in the eye of the researcher does not necessarily entail a lack of mental processing. Selected strategies will be assumed to be observable, but it is essential for a researcher to allow for the possibility that test-takers might use a strategy provided in a questionnaire, but fail to report it. Within individuals, consciousness about strategy use may exist differently. The strategies that have been identified may become processes for some individuals, but have remained strategies for others. Strategy use also depends on the proficiency levels of the individuals and the task difficulty or demands. For example, high proficiency test-takers encountering an easy test task might report low use of a checking-for-accuracy strategy (i.e., a monitoring strategy) while performing the task as either the task was simply so easy that monitoring was not needed or this strategy might become so automatic that they did not realize they used it. Lower proficiency test-takers, on the other hand, might also report low use of this strategy, perhaps not because it had become automatic, but perhaps because they might be deficient in its use. Let us assume that the former obtain high scores while the latter receive low scores on the same task. The relationship between the strategy use and the performance among the former group seems weaker than that of the latter group.

2 Metacognition

The basic concept of metacognition is the notion of thinking about thinking. 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). Metacognition involves active monitoring and consequent regulation and orchestration of cognitive processes to achieve cognitive goals. One of the most frequently discussed issues in metacognition is 'should thoughts once metacognitive that have become automatic through repeated use and overlearning still be called metacognitive?' This is an important issue that is related to how strategies have been defined in the present study. According to Ericsson and Simon (1993), since people are likely to be aware only 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, 1998: 8). This perspective is beneficial for research purposes 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.

Metacognitive strategies are the test-takers' deliberate mental behaviours for directing and controlling their cognitive strategy processing for successful performance. They are conceived as higher order executive processing that provides a cognitive management function in language use and other cognitive activities. In the present study, they are composed of two distinct, but interrelated strategies: planning and monitoring. Planning strategies refer to test-takers' action of previewing or overviewing tasks to complete in order to develop directions of what needs to be done, how and when to do it. Metacognitive planning strategies (Kluwe, 1982: 212) are those directed at the regulations of the course of their own thinking. They help to:

- allocate resources to the current task;
- determine the order of steps to be taken to complete the task; and
- set the intensity or the speed at which one should work on the task.

Monitoring strategies are test-takers' deliberate action to check, monitor and evaluate their thinking and performance, so that verifications can be made if needed in order to perform the given tasks successfully. Evaluating strategies are viewed as part of monitoring strategies that possess some criteria for making decisions on how well they have completed, are completing and will complete the tasks. Metacognitive monitoring strategies help to (Kluwe, 1982: 212):

- identify the task on which one is currently working;
- check on the current progress of that work;
- evaluate that progress; and
- predict what the outcome of that progress will be.

Cognitive strategies differ from metacognitive strategies in that they are likely to be encapsulated within a subject area (e.g., EFL), whereas metacognitive strategies span multiple subject areas (Schraw, 1998). Cognitive strategies are the test-takers' ongoing mental activities to use their language and world knowledge to solve the given tasks. Two broad categories of language knowledge are organizational knowledge and pragmatic knowledge (see Bachman, 1990). World knowledge is general knowledge such as knowledge about economy, business, politics, environment and science that may be related to the tasks. All this knowledge is located in domains of information in memory available for use by metacognitive strategies (Bachman and Palmer, 1996). Cognitive strategies are, for example, making prediction, translating, summarizing, linking with prior knowledge or

experience, applying grammar rules and guessing meaning from contexts (e.g., O'Malley and Chamot, 1990; Oxford, 1990).

3 L2 reading strategy research

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 way they reason about what has been read and in the kinds of inferences they may draw from their reasoning. 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 slower and less successful than L1 (Cohen, 1994). This also depends on factors such as the levels of readers' proficiency, types of text, text difficulty and task demands. Also, in understanding a text, they may encounter unknown words, unfamiliar syntax (e.g., complexity of sentences) and may not be able to use appropriate prior knowledge to help comprehend the text. Alderson (2000) has extensively treated the subject of variables affecting the nature of reading.

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 metacognitive strategies involved in reading comprehension:

- clarifying the purposes of reading;
- identifying the important aspects of a message;
- monitoring ongoing activities to determine whether comprehension is occurring;
- engaging in self-questioning to determine whether goals are being achieved; and
- taking corrective action when failures in comprehension are detected.

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., Politzer and McGroarty, 1985; Abraham and Vann, 1987; Chamot *et al*., 1989; Oxford, 1989; Kaylani, 1996). The literature of metacognitive strategies in reading comprehension reveals that poor readers in general lack effective metacognitive strategies (e.g., Brown, 1989; Alderson, 2000) and have little awareness on how to approach reading (e.g., Baker and Brown, 1984). They

also have deficiencies in the use of metacognitive strategies to monitor their understanding of texts (e.g., 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 L2 test performance in relation to strategies used by test-takers through the process of taking the test (for an extensive discussion on test-taking strategy research, see Cohen, 1998a; 1998b). The major attempt of early L2 reading studies in test-taking strategies was to identify and describe test-taking strategies. These studies attempted to draw a distinction between what readers did 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). Recently, there have been studies looking at strategies test-takers might employ when taking a test. Closely related to the present study is the study conducted by Purpura (1997; 1998; 1999). Purpura investigates the relationship between test-takers' cognitive and metacognitive strategy use and performance on L2 tests, using structural equation modeling and exploratory factor analyses. The 1382 subjects answered an 80-item cognitive and metacognitive strategy questionnaire before taking a 70-item standardized language test. The results indicate that cognitive strategies are directly and positively related to the test performance. Metacognitive strategies have a significant, direct, positive relationship to cognitive strategies and are indirectly related to the test performance. Metacognitive strategies exert an executive function over cognitive strategies. Purpura also found that successful and unsuccessful test-takers or readers invoke strategies differently. For example, the low performers showed an extremely high degree of metacognitive strategies in retrieving information from the 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. That is, test-takers need a certain degree of language knowledge before they can make use of it.

In summary, the present theoretical frameworks discussed seem to have important implications for the formulation of the metacognitive theory in L2 reading test performance. The use of cognitive and metacognitive strategies may depend on the kind of test-takers, the setting in which testing occurs and the nature of test tasks. Previous research studies might have possessed various factors that resulted in their significant findings. For example, in an English as a second language (ESL) context, ages, cultural backgrounds and English proficiency levels may be different from EFL settings. 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. A Thai-government university setting may be of interest to investigate such a relationship because the participants may be different from those in other previous studies. For example, in this study they were the same age group, had a small range of English proficiency levels and shared the same cultural and educational context. There are three research questions:

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

III Method

1 Background and participants

The study was carried out at one of the major universities in the north of Thailand using a fundamental English course in which reading comprehension skills were emphasized in the assessment of students' achievement. The data were gathered during the final examination. There were 384 Thai students for quantitative data analyses, made up of 173 males (45%) and 211 females (55%). There were 75 highly successful, 256 moderately successful and 53 unsuccessful test-takers. Eight (i.e., 4 highly successful and 4 unsuccessful) test-takers were selected for retrospective interviews. They were between the ages of 17 and 21 and had been studying English in Thailand for about 8 years.

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 were 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 thought should be considered 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% or above, between 46 and 69% and below 45% on the test score were grouped as 'highly successful', 'moderately successful' and 'unsuccessful', respectively. By using these criteria, the normal distribution in the particular groups was produced.

2 Measurement instruments

The following were research instruments in the study:

a Reading comprehension test: The following are examples of the objectives of the English course in teaching reading skills:

1) scanning and skimming text for general and specific information;
2) finding answers explicitly or implicitly to questions;
3) recalling word meanings;
4) skimming to evaluate information;
5) guessing meanings of unknown words from context clues;
6) identifying phrases or word equivalence;
7) predicting topics of passages and the content of a passage from an introductory paragraph;
8) recognizing abbreviations of words;
9) making decisions for appropriate information;
10) discriminating between more or less important ideas;
11) discriminating facts from opinions;
12) analysing reference words;
13) drawing inferences from the content;
14) identifying the title of the text and the appropriate headings;
15) summarizing the content of the given text; and
16) finding the main ideas.

The multiple-choice reading test was developed and piloted for content and reliability analyses by the researcher and the teachers at the Thai University. The test consisted of two main sections: (1) gap-filling cloze and (2) reading comprehension. Section 1 consisted of two passages with 20-item gaps and 2 dialogue passages with 25-item gaps for the test-takers to fill in. This section was designed to measure the test-takers' ability to comprehend texts using both structural and lexical appropriacy. Section 2 consisted of 4 passages, ranging from 139 words to 657 words. This section aimed to measure the test-takers' ability to read English texts for main ideas, details and inferences, etc. as defined in the objectives of the course above. The topics in the test were related to the topics taught in the class, such as family, food and drink, clothing, health, travels and transportation. The test lasted 3 hours. After being implemented, it was analysed using the Rasch model of Item Response Theory (IRT) (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 the approximate reliability of .88 (Part 1: .80; Part 2: .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.

b Cognitive and metacognitive questionnaire: The researcher developed a questionnaire to measure cognitive and metacognitive strategies drawing from the literature in reading, learning and test taking strategies. In particular, the questionnaire items in the study were similar to Purpura's (1999), but adjusted to suit a reading test. The initial questionnaire was piloted with the participants during their midterm test and analysed for reliability before actual use in the main study. The wording of questionnaire items was scrutinized in the case that it might measure unintended strategies or negatively affect the measurement. In addition, two experts in metacognition not involved in the study were asked to determine to which category each item belonged. Their responses were scored as 1 or 0 in association with the strategy types assumed. Experts 1 and 2 had 91.43% and 85.71% of agreement with the strategy categorizations, respectively. Since the questionnaire (see Appendix 1) was given after students had completed the test, 'past tense' was used to express their thinking. The questionnaire used a 5-point Likert scale: 1 (Never), 2 (Sometimes), 3 (Often), 4 (Usually) and 5 (Always). Table 1 presents the taxonomy of the questionnaire with the reliability estimates. Note that Items 1, 3, 10, 11, 12, 13, 34 and 35 were excluded due to their low item–total correlations and relatively low alpha.

The cognitive and metacognitive strategy items in Table 1 were factor-analysed as a step in understanding the clusterings of the items. An EFA (exploratory factor analysis) was performed to examine a set of strategy variables to identify groups of variables that were relatively homogeneous, i.e., highly correlated. Since the factors were

Table 1 A taxonomy of the cognitive – metacognitive strategy questionnaire

Processing	Subscale		Number of items	Items used	Reliability
1. Cognitive strategies	Comprehending		5	2, 6, 7, 8, 9	.748
	Retrieval		4	4, 5, 20, 28	.586
		Subtotal	9		.803
2. Metacognitive strategies	Planning		11	14, 16, 18, 21, 22, 24, 25, 29, 31, 32, 33	.869
	Monitoring		7	15, 17, 19, 23, 26, 27, 30	.767
		Subtotal	18		.910
		Total	27		.928

expected to be correlated, an oblimin solution was used in an exploratory factor analysis. The present study used the 'principal axis factoring' method. An examination of the correlation matrix indicated that a considerable number of correlations exceeded .3, and thus the matrix was suitable for factoring. The Bartlett's test of sphericity was significant and the Kaiser–Mayer–Olkin measure of sampling adequacy was greater than .8 (i.e., .938). An inspection of the anti-image correlation matrix revealed that all the measures of sampling adequacy were well above the acceptable level of .5. Factor loadings greater than .3 were considered in this analysis.

The factor loading structures were not apparent when all the cognitive and metacognitive strategy items were factor analysed together. Despite the fact that 4 factors (i.e., comprehending, retrieval, planning and monitoring strategies) were expected, a 5-factor oblimin solution seemed apparent in this analysis. The factor extraction yielded 5 eigenvalues greater than 1.0, which accounted for 53.5% of the variance. It was then decided that items loading on more than one factor would be deleted for a further factor analysis because these items might not measure the intended construct. In a later factor analysis, the factor extraction yielded 2 eigenvalues greater than 1.0 which accounted for 45.77% of the variance. However, Items 16, 17 and 18 loaded on the two factors. By examining the wording of the items, it was determined that these items might potentially overlap the two strategy categories and they were thus deleted for a further factor analysis. The final factor analysis yielded 2 eigenvalues greater than 1.0, accounting for 46.21% of the variance (see Table 2).

This analysis indicated the most apparent structure of factor loading. In Table 3, Factor 1 consists of planning and monitoring strategies (i.e., metacognitive strategies), whereas Factor 2 is composed of comprehending strategies (i.e., cognitive strategies). The inter-factor correlation was .56. These two composites of the metacognitive and cognitive strategies are used in the subsequent analysis, i.e., Pearson Product Moment correlations and multivariate analysis of variance (MANOVA). Table 4 presents the composites for metacognitive and cognitive strategies with the reliability estimates. The reliability

Table 2 Results of exploratory factor analysis

Factor	Description	Eigenvalue	Percentage of variance	Cumulative percentage
1	Metacognitive strategies	5.652	37.678	37.678
2	Cognitive strategies	1.280	8.531	46.209

Table 3 Pattern matrix of factor loading of the original EFA

Item	Component	
	Factor 1	Factor 2
32	.815	
31	.791	
30	.707	
22	.668	
21	.646	
15	.610	
33	.595	
24	.592	
14	.415	
19	.357	
9		.736
8		.729
6		.726
7		.647
2		.630

Table 4 Composites of cognitive and metacognitive strategies with reliability estimates

Strategies	Number of items	Items used	Reliability
1. Cognitive	5	2, 6, 7, 8, 9	.748
2. Metacognitive	10	14, 15, 19, 21, 22, 24, 30, 31, 32, 33	.854
Total	15		.879

estimate of these strategies was acceptable given the number of the items. Cognitive and metacognitive strategy variables were averaged by the number of items; for example, Items 2, 6, 7, 8 and 9 were divided by 5 to form the cognitive strategy composite. The purpose of dividing was to also make a meaningful interpretation, i.e., 1 means 'never' whereas 5 means 'always'.

c Retrospective interviews: Triangulation is data gathering and reconciling from several sources and/or from different data gathering techniques to recheck or reassure what counts as evidence (see Lynch, 1996). The only relevant qualitative data in this study is what the test-takers have to say about their own strategy use. In the study, triangulation was accomplished by combining the test and questionnaire data with retrospective interview data. The interviews were carried out to gather extra information in relation to the research questions. The advantage of this combination is that the researcher can

use the interview data to arrive at useful explanations for some quantitative findings. There were, however, some limitations of the qualitative data gathering, for example, a small range of achievement groups (i.e., only 4 highly successful and 4 unsuccessful test-takers) and the lack of some follow-up questions during the interviews. Thus, the strategy relationship trends emerged from the qualitative data should be viewed as suggestive. Some qualitative findings that emerged from the data are presented in data display matrices (like those in Miles and Huberman, 1994) and in anecdotal form. This kind of presentation, may, however, be suspect in the eyes of some people as it might not be as meaningful or convincing as quantitative data. This kind of presentation may, nevertheless, be useful for a better understanding of the nature of cognitive and metacognitive strategies.

The interviews were conducted in Thai and lasted about 30 minutes. The names used were pseudonyms. First, the participants were asked about their attitudes towards learning English and reading in English. They were then asked to report on strategies they used when attempting to complete the reading comprehension test in their final examination. At this stage they were provided with the reading comprehension test to help remind them of how they thought. They were then given 10 minutes to do a reading test (consisting of a short reading comprehension passage and 6 multiple-choice comprehension questions) designed to simulate a test situation. Although this activity could not be considered a real test, the reading activity was identified to be parallel and similar to that in the final achievement test. Ten minutes would be an adequate period of time to complete such an activity. This might, however, be another limitation of the qualitative data gathering. That is, this activity was not equivalent to a test because the number of the tasks and the participants' performance in this activity did not influence their 'life' as the test did. Nevertheless, the participants were asked to carry out this activity the way they would do in a real test. They were then asked about their strategy use when trying to comprehend the reading passage and complete the questions. It also emerged that the interviewees reported test-taking strategies rather than reading strategies because, for example, they were asked to explain why in Question 1 they chose 'A' as the correct answer and why not the others. The study therefore makes no claim to provide a comprehensive analysis of the strategy use reflected from the qualitative data due to the limitations.

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 or trends of how the test-takers used metacognitive and cognitive strategies in the reading test based on the thematic framework in relation to cognitive and metacognitive

strategies and reading comprehension. The procedures of the analysis data were as follows:

- developing a thematic framework;
- organizing the data;
- coding the data;
- reducing the data; and
- interpreting the data.

These analytic procedures were not a linear series of steps, but rather iterative in that they included revisiting the coding stage after reducing the data (Lynch, 1996). 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. In this case, the codes were not used as a measure of these strategies or to test hypotheses, but to discover themes or issues that might appear from the dataset. After the transcripts were coded and rechecked for coding consistency, common patterns of metacognitive and cognitive strategy use were identified.

3 Quantitative data analyses

In the quantitative data analysis, a significance level of 0.05 ($p < 0.05$) was set. SPSS version 9 for PC (SPSS, 1999) was used to compute descriptive statistics and perform reliability analyses, Pearson product moment correlations, EFA and MANOVA. Pearson product moment correlations were conducted to simply investigate the relationship between strategies and the reading test performance. MANOVA was used to compare groups of test-takers (i.e., highly successful, moderately successful and unsuccessful) exposed to two or more levels of independent variables. Factorial MANOVA can accomplish the task of examining the effects of independent variables (i.e., success levels and gender in this study) including both main and interaction effects on dependent variables (e.g., metacognitive strategy and cognitive strategy use). The advantages of MANOVA are that it provides tests of the effects of several independent variables and the effects of treatment combinations within a single analysis. MANOVA also reduces the likelihood of Type I and II errors. In this analysis, 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 dataset. 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 ($F = 76.182$,

$p < .05$, $\eta^2 = .377$). Cohen (1977) characterizes Eta squared (η^2) or the ratio of the explained variance to total variance as follows: $\eta^2 = 0.01$ as a small effect size; $\eta^2 = 0.06$ as a medium effect size; and $\eta^2 = 0.14$ as a large effect size. Use of this magnitude-of-effect estimate can assist the researcher in clarifying if the statistically significant findings are of practical or meaningful significance within the context of an empirical investigation, i.e., whether the significant findings are likely to be the result of an artifact of a sample size in the course of rejecting H_0. Accordingly, in the present study, the univariate *F* tests for the different groups could be interpreted.

IV Interpreting the results

1 Descriptive statistics

Table 5 presents the distributions for the cognitive and metacognitive strategies. Table 6 presents the distributions of the composite variables. All the variables were normally distributed (i.e., skewness and kurtosis statistics were near zero). Table 7 presents the descriptive statistics of the test-takers' test scores and strategy use categorized by success.

2 Relationships between cognitive and metacognitive strategies and EFL reading performance

There was a positive relationship of cognitive strategies and metacognitive strategies to the reading test performance ($r = .391$ and .469, respectively). The fact that the relationship of cognitive and metacognitive strategies to the reading performance was weak (i.e., explaining about 15–22% of the test score variance) might be because there were factors other than these strategies – such as language ability, test method effects and error of measurement – that could be used to explain the test score (see Bachman, 1990). This relationship yielded a reasonably meaningful interpretation because strategies come into play only when test-takers are faced with difficulties or problems. That is, when their routine or skilful behaviours are not enough to resolve a difficulty in a given situation, conscious, intentional and effortful processing takes over. Although skills and strategies are both in the forms of procedural knowledge, their significant differences are relevant to first the automaticity of processing and second to the individual's deliberation (see Alexander *et al*., 1998). The correlation between cognitive strategies and metacognitive strategies was .608. This correlation was moderate despite the fact that it was expected to be much higher. This might have resulted from the number of the

Table 5 Distributions for the cognitive and metacognitive strategies

Item	Mean	SD	Skewness	Kurtosis	Median	Mode
1	2.073	1.022	.680	–.172	2.000	1.000
2	3.714	.989	–.443	–.405	4.000	4.000
3	3.354	.969	–.327	–.380	3.000	4.000
4	3.391	1.006	–.116	–.420	3.000	3.000
5	3.638	.926	–.330	–.195	4.000	4.000
6	3.958	–.925	–.555	–.465	4.000	4.000
7	3.302	1.016	–.076	–.461	3.000	3.000
8	3.555	.965	–.217	–.479	4.000	4.000
9	3.753	1.016	–.449	–.460	4.000	4.000
10	2.945	1.145	.097	–.703	3.000	3.000
11	2.935	1.234	.066	–.917	3.000	3.000
12	2.484	1.045	.159	–.634	3.000	3.000
13	3.068	1.103	–.217	–.588	3.000	3.000
14	3.719	.858	–.274	–.169	4.000	4.000
15	3.367	.947	–.124	–.325	3.000	3.000
16	3.836	.859	–.348	–.395	4.000	4.000
17	3.730	.876	–.288	–.253	4.000	4.000
18	3.646	.967	–.252	–.448	4.000	3.000
19	3.896	.925	–.488	–.427	4.000	4.000
20	3.518	.894	–.132	–.233	3.000	3.000
21	3.255	.884	–.043	–.147	3.000	3.000
22	3.210	.862	–.385	.112	3.000	3.000
23	3.576	1.004	–.489	–.123	4.000	4.000
24	3.620	.909	–.118	–.593	4.000	4.000
25	3.479	.882	–.155	–.090	3.000	3.000
26	3.383	.844	–.034	.098	3.000	3.000
27	3.352	.947	–.124	–.510	3.000	3.000
28	3.354	.969	–.171	–.069	3.000	3.000
29	3.354	.888	–.194	–.008	3.000	3.000
30	3.654	.853	–.309	.123	4.000	4.000
31	3.576	.925	–.292	–.329	4.000	4.000
32	3.471	.882	–.177	.007	3.000	3.000
33	3.810	.823	–.173	–.610	4.000	4.000
34	3.831	1.050	–.501	–.676	4.000	5.000
35	3.891	1.059	–.682	–.179	4.000	5.000

Table 6 Distributions for the cognitive and metacognitive strategy use variables

Variable	Mean	SD	Skewness	Kurtosis	Median	Mode
Cognitive strategies	3.656	.693	–.288	–.442	3.600	4.000
Metacognitive strategies	3.557	.584	.040	–.469	3.600	3.000

strategy items representing the strategy composites. The correction-for-attenuation correlation (Hatch and Lazaraton, 1991: 444) between cognitive and metacognitive strategies, however, was .761.

Table 7 Descriptive statistics by success

	Success	Mean	SD
EFL reading performance	Unsuccessful	32.415	6.172
	Moderately successful	47.957	5.167
	Highly successful	62.493	3.937
Cognitive strategies	Unsuccessful	3.132	.648
	Moderately successful	3.695	.660
	Highly successful	3.896	.657
Metacognitive strategies	Unsuccessful	3.089	.490
	Moderately successful	3.553	.539
	Highly successful	3.903	.562

3 Factorial MANOVA

Table 8 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. The statistically significant differences found in the present study were therefore due to the main effects only. The results showed that there was a statistically significant difference in the use of cognitive and metacognitive strategies among highly successful, moderately successful and unsuccessful students. It can be concluded that the factorial MANOVA was significant because:

- the small p values suggested that the chance of the results being attributable to Type I error was small; and
- the Eta squares showed taht the effects explained nontrivial portions of the variance in the dependent measures.

Note that the significant differences in the test performance with a very large effect size of was not surprising given that the levels of success had already been established prior to the analysis.

Table 8 Factorial MANOVA results for success levels

Dependent variables	df	F	p	η^2	D^2
EFL reading test performance	2	538.211	.000	.740	1.000
Cognitive strategies	2	23.341	.000	.110	1.000
Metacognitive strategies	2	38.876	.000	.171	1.000

Notes: Mahalanobis distance (D^2) or observed power was computed using alpha = .05. D^2 was presented as the multivariate effect size measure with the following guideline for interpretation: D^2 = .25 a small effect; D^2 = .50 a medium effect; and D^2 = .1 a large effect (Cohen, 1977).

Scheffé *post hoc* tests (see Table 9) were conducted to point out which contrasts were different. As can be seen, there were statistically significant differences across the groups, except that the highly successful and moderately successful test-takers' use of cognitive strategies was not significant. Perhaps, the highly successful and moderately successful test-takers had an equal ability to use cognitive strategies. However, that the highly successful test-takers were more metacognitive than the moderately successful ones distinguished their achievement levels.

4 Qualitative data results

The qualitative results demonstrated the closely interactive relationship between cognitive strategies and metacognitive strategies (see Table 10). Most cognitive strategies occurred in association with metacognitive strategies. For example, test-takers need to be metacognitive to use cognitive strategies such as elaboration, inferencing and transferring. Some cognitive strategies might even perform a metacognitive function. For example, in Table 10, in (1) translation was rather a metacognitive strategy because the goal of using this strategy was to make an evaluative judgement about whether the text made sense; and in (2) summarizing seemed to be metacognitive since the test-takers wanted to evaluate whether the text was understandable; if test-takers summarized the text to determine whether they were ready to proceed, summarizing would be metacognitive. That is, the same strategy in one occasion may be cognitive while in another occasion it may be metacognitive. For example, if test-takers translate a text so that they can memorize the general idea, translation seems

Table 9 Scheffé *post hoc* test of differences across the success groups

Dependent variable	(I) Success	(J) Success	Mean differences (I–J)	Standard error	*P*
EFL readingperformance	High-successful	Mod-successful	14.536	.670	.000
	High-successful	Unsuccessful	30.078	.916	.000
	Mod-successful	Unsuccessful	15.542	.771	.000
Cognitive strategies	High-successful	Mod-successful	.202	.086	.066
	High-successful	Unsuccessful	.764	.118	.000
	Mod-successful	Unsuccessful	.563	.098	.000
Metacognitive strategies	High-successful	Mod-successful	.350	.070	.000
	High-successful	Unsuccessful	.814	.095	.000
	Mod-successful	Unsuccessful	.464	.080	.000

Table 10 Relationships of metacognitive and cognitive strategies to reading comprehension achievement

Relationships to reading test performance	Examples
Metacognitive strategies and Cognitive strategies	1. Reading a passage by translating it into Thai (selective attention – planning strategy and translation – cognitive strategy). Translating as reading (cognitive strategy) and judged if it made any sense and understandable (comprehension monitoring – monitoring strategy) 2. Reading the whole passage (selective attention – a monitoring strategy) and at the same time noticing whether it was understandable by summarizing (summarization – cognitive strategy and comprehension monitoring – monitoring strategy); Going further to other parts of the passage (performance evaluation – monitoring strategy) if the text was understandable. 3. Reading the questions to see what was asked (comprehension monitoring – monitoring strategy) and then trying to eliminate bad alternatives (evaluating – monitoring strategy) by referring back and forth to the passage (repetition [either a cognitive strategy or monitoring strategy] or double-checking – monitoring strategy using external standards with the text); finally selecting the most suitable answer (evaluation – monitoring strategy) 4. Reading a passage quickly to determine the topic of the passage (summarizing – cognitive strategy and monitoring strategy) 5. Using prior knowledge or experience to help understand the passage or test (retrieval or elaboration – cognitive strategy)

to be a cognitive strategy. If, however, they translate the same text to make sure that what they have understood is accurate, translation seems to be metacognitive rather than cognitive. In previous research, the distinction between cognitive and metacognitive strategies, thus, may be a little too optimistic, given that at one level, it may be true.

It is therefore likely that goals of using a strategy determine whether a strategy used is cognitive or metacognitive (see Flavell, 1992). If the test-takers read a text to gain knowledge (a cognitive goal), they may be using cognitive strategies. If they read the text because they wonder if the text has been well understood (a metacognitive goal of assessing one's knowledge), they may be using metacognitive strategies. However, this, to some extent, does not make the distinction between cognitive and metacognitive clear because cognitive – metacognitive goals seem to form a continuum. This ambiguity suggests a need to further investigate underlying reasons why a

particular strategy is used, so that a theory of cognitive – metacognitive distinction could be rigorously produced. This may help unlock the key to distinguishing cognitive strategies from metacognitive strategies.

From an identification of multiple occurences 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 11). The qualitative analysis suggested that metacognitive behaviour was continual (i.e., happened at all times), rather than falling into discrete categories. For example, similar cognitive and metacognitive strategy processing identified as occurring before the test could occur during the test. In other words, cognitive and metacognitive strategy processing in language use may be explained as a non-algorithmic system where strategic thinking is not necessarily step by step, because particular strategies may be activated only as needed.

Table 11 Phases of metacognitive strategy use

Phases	Examples
Before test task completion	1. Looking through all the test pages and noticed what they were about (advance preparation or assessing situations – planning strategy) 2. Determining which parts or sections of the test were easy or difficult (advance preparation – planning strategy) 3. Setting time to complete for each part of the test (time management – planning strategy)
During test task completion	4. Checking if what had been understood from the passage made sense and was understandable, usually by translating, re-reading the passage and questions and sometimes using prior background knowledge about the topic (comprehension check – monitoring strategy) 5. Checking whether the answer chosen was shown or implied in the passage (double-checking or error monitoring – monitoring strategy) 6. Checking work while progressing through the test (performance monitoring or assessment – monitoring strategy)
After test task completion	7. Immediately rechecking the answers if found one had chosen, for example, '10 Ds' in a row because something could have been wrong (performance evaluation – monitoring strategy) 8. Rechecking all the answers in terms of accuracy (e.g., the correspondence between the answer chosen and the answer sheet) after completing all the questions (double checking – monitoring strategy).

The qualitative data suggested that although cognitive and metacognitive strategy use could be classified as occurring before, during and after the action as proposed by Wenden (1991), their use was more related to the behaviour than to the time (Purpura, 1999). 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 their metacognitive monitoring of how well their plans were working and when to modify such plans. 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., O'Malley *et al*., 1989; Wenden, 1991) might be appropriate only in a simple language task. These models might not be useful for the theoretical underpinning strategy-based conceptual framework in L2 reading comprehension, especially in a situation like testing where multiple sources of information and tasks are presented under time constraints.

In addition to these two matrices, metacognitive strategies were qualitatively reflected by the successful test-takers. The highly successful test-takers 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 flipped through all the pages to see which parts or sections were easy or difficult. I completed 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.

These highly successful test-takers knew which planning, monitoring and cognitive strategies worked best for them to complete the test tasks at hand. However, it might be worthwhile to decide carefully whether Dara's and Amnaj's metacognitive strategy use to complete the test that might positively influence their achievement in the test should be part of the test construct. Should it be 'error of measurement'? If it were, to what extent could we make inferences on the test-takers' reading ability based on their test scores?

Finally, despite the fact that the study did not focus on affect, these qualitative examples clearly show that metacognitive strategy use linked affective states to ease pressure or anxiety and therefore to 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 realization that he might 'get tense' during the test. Is assessing one's feeling (e.g., anxiety), as a function of metacognitive strategies, part of strategic competence? This raises an issue for future LT research to explore the nature of metacognition in relation to affect.

V Metadiscussion

The heart of the findings in the present study was dependent upon how the terms for investigation were defined and the methods of data gathering and data analyses. For example, strategy items intended to assess particular cognitive and metacognitive strategies might have turned out to assess others, for example, due to the wording of the strategy items and test-takers' misinterpretations of the item meaning. The main problem the study encountered was the adequate number of questionnaire items to identify underlying factors. This might have decreased an ability to understand the nature of cognitive and metacognitive strategies. Accordingly, caution needs to be taken in an attempt to discuss and generalize the findings. Perhaps in future research, more questionnaire items are needed in order to separate planning from monitoring, comprehending from retrieval and eventually cognitive from metacognitive. However, the large number of questionnaire items might negatively affect the internal validity of the research. For example, first, voluntary test-takers needed to answer the questionnaires after they had finished the 3-hour test; it was likely that they might not have answered the questionnaire or, if they did, it might be incomplete. This effect was experienced in the present study. The study originally had 520 participants, but due the incomplete questionnaire data, the number of the participants was dropped to 384. Secondly, if they had to answer a many-item questionnaire such as 70 items, it was likely that they might not read it properly to understand the statements or might just answer the questionnaire without reading. This could have been worse if the questionnaire was given in English. Imagine we were in that situation and had just completed a difficult test and we were upset about our poor performance. Would we like to answer a questionnaire that might take another 20 minutes before we could leave the test room? Accordingly, an important task for LT researchers is to find a way to develop a precise questionnaire that validly measures the defined strategy constructs.

Regardless of some limitations to the study, the nature of cognitive and metacognitive strategies in relation to reading test performance could be elaborated on and discussed with caution. Cognitive and

metacognitive strategies might need to be viewed as two interactive facets of the same mental process that do not occur independently of each other. There are difficulties distinguishing cognitive strategies from metacognitive strategies as suggested in the literature (see Brown *et al*., 1983; Wilson, 2000). 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, summarizing the main idea of the text would not be effective if the acts 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 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 fact, the plausible reason that it might not be possible to find the distinction between cognitive and metacognitive strategies in studies of this sort is because they do not exist across an aggregate of individuals, although the distinction may exist within individuals depending upon the task.

Evidence from the present study might help suggest that the nature of metacognitive strategies and cognitive strategies may be multidimensional in their own right, but they might be located beneath a unidimensional construct of strategic competence. It is, however, 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 metacognitive strategies only. The bulk of the literature in metacognition and reading comprehension suggests that metacognitive strategies are only part of metacognition. We need to distinguish strategies from strategic competence because learners' use of strategies can yield either valid or invalid performance and some strategies are not necessarily within their strategic competence (e.g., in the case of innovative/creative behaviour). Further, the use of a valid strategy implies neither an understanding in the need to use them nor an awareness of the pitfalls of using a less adequate strategy. More, thus, seems to be involved in the nature of this competence than the ability to execute valid strategies *per se*. 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. The term 'metastrategic competence' seems not only more straightforward than strategic competence, but it also covers the notion of metacognition. Therefore,

metastrategic competence should be conceptualized as a higher-level cognitive background that underlies all kinds of strategies when the context allows (e.g., cognitive, metacognitive, affective and social strategies). Hence, strategies should be viewed as the things learners react to in response to a problem or difficulty, and accordingly metacognitive strategies are not equivalent to this competence. Individual test-takers who are metastrategically competent are more likely to understand how the strategies fit together and how they are related to language tasks or TLU domains than those with little of this competence.

It is also 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, some researchers have not made a clear distinction between state and trait notions when investigating metacognitive and cognitive strategy constructs. States and traits refer to two different classes of psychological attributes for describing people (see Hong, 1998a; 1998b). It is believed that each individual has both a transitory state and a relatively stable trait. 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 of people. For example, state cognitive and metacognitive strategies are a transitory state of the test-takers in an intellectual situation that varies in intensity and changes over time. On the other hand, trait cognitive and metacognitive strategies are considered a relatively stable individual difference variable to respond to intellectual situations with varying degrees of state 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 investigated state cognitive and metacognitive strategy use (see the secton on Method above). Chapelle (1998: 65) points out that the task analysis investigating the strategies used in an operational setting forces the researchers to recognize 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. Test-takers can never take the same test twice and, therefore, each time they take a test, it is a different one with new demands. They of course need to have a few test-taking skills that they can adjust and apply to the current challenges when the same procedures they used last time no longer works. That procedure, though, has merit now only to the extent that it taught them something useful for taking a second and somewhat different test. Understanding the nature of operational settings across which

consistent performance can be observed is essential in order to make further substantive progress in understanding the construct definition of the interactionalists.

VI Concluding remarks

The present study aimed at investigating the nature of cognitive and metacognitive strategies in relation to the EFL reading test performance. This study was motivated from the assumption that the variability in language test performance can be attributed to test-taker characteristics (e.g., Bachman, 1990). The findings in the study suggest that cognitive and metacognitive strategy use 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, 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 cognitive and metacognitive strategies to EFL reading performance could have been far more complicated than what has been found or implied. In addition, the nature of cognitive and metacognitive strategies found in the present study is not comprehensive because the study excluded other factors such as affect (e.g., motivation and volition) that might be related not only to language test performance, but also to the way in which cognitive and metacognitive strategies were used. The types of cognitive and metacognitive strategies in the study were only part of the possible strategies the students might have used during the reading test.

Nevertheless, this study has opened further areas of investigation into the relationship of cognitive and metacognitive strategies in L2 testing. First, given the assumption that state cognitive and metacognitive strategies in an operational test setting change over time, the construct definition inquiry process is to observe the consistency of test-takers' use of these strategies at different times in various test method facets. It is recommended that replications of the present study are carried out mainly in the hope that performance consistency in the use of cognitive and metacognitive strategies could be observed, not just to find out whether the findings in the study would be the same or different in other contexts such as ESL or foreign languages other than English. The same test-takers do not necessarily use the strategies the same way they did in the same test. Secondly, effects of test methods and text difficulty on cognitive and metacognitive strategy use at various English proficiency levels should be

examined since levels of reading text difficulty and task demands could result in different processing of metacognitive and cognitive strategies.

Thirdly, more research emphasizing 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. Perhaps, learning strategies should be viewed as 'traits' as they result in long-term memory while 'acquiring the target language', whereas use strategies should be viewed as 'states' since they are current strategies and relate closely to working memory while completing assigned tasks. State and trait strategies may need to be distinguished, and then measured and treated in different manners. The degree of stability over time might help distinguish the conceptual nature of trait and state constructs. Trait strategies may be less situation specific and can therefore be measured at any time in order to obtain a consistent trait measure. State strategies should be measured and interpreted for a specific evaluative TLU situation. It might therefore be logical to assume that traits are more stable than states and that states are more related to a specific test performance than traits. Nonetheless, a situational effect and an effect of the interaction between test-takers/learners and a situation may contaminate a 'psychological assessment of traits'. For example, it is likely that test-takers/learners report on their trait strategies by relating them to TLU situations. To better understand the psychology of the learners, future research needs to investigate the relationship between their perceived strategy use in general and their actual strategy use in a specific situation.

Fourthly, the extent to which the use of cognitive and metacognitive strategies in a reading comprehension test is similar to that in nontest reading comprehension needs to also be identified in order to, first, make inferences or claims on actual reading ability measured and, secondly, to identify whether some metacognitive strategies should be considered a source of measurement error (i.e., construct-irrelevant; Messick, 1996). Individuals who are metacognitive in test-taking may be likely also to be metacognitive in other kinds of learning activities. Nevertheless, as situational contexts seem to influence the individuals' performance, this assumption needs validation. Finally, this study has shown that although the sample size was small, qualitative data could illustrate test-takers' behaviours, i.e., how and why they use metacognitive strategies to regulate cognitive strategies. Other issues underlying the use of strategies may emerge from qualitative data such as affect. It is therefore recommended that future research combine quantitative and qualitative data gathering and analysis methods.

To conclude, it is hoped that the present study has not only helped make a contribution to a theory of cognitive and metacognitive strategy use and L2 reading test performance, but has also offered some possible ways to look at some theoretical and methodological perspectives for assessing cognitive and metacognitive strategies. Future research should address the need for a better definition of strategic competence in language test performance. A comprehensive theory may need to take the following factors into account:

- the nature and magnitude of situational reading and strategic competence in test and nontest situations; and
- the measurement of the level of intensity of L2 reading ability and strategic competence evoked by a particular situation.

It is hoped that the lid of the Pandora's box (McNamara, 1996) has been lifted and some of its contents have been investigated in this study.

Acknowledgements

If I were cognition, the following people would deserve the roles of metacognition: Brian Lynch, who supervised this research project, Paul Gruba, Tim McNamara, Sirikarn Chanruang, William Bonk, the *Language Testing* anonymous reviewers and the Editors. Without metacognition, this research article would not have been achieved.

VII References

Abraham, R.G. and **Vann, R.J.** 1987: Strategies of two learners: a case study. In Wenden, A.L. and Rubin, J., editors, *Learner strategies in language learning.* New York: Prentice Hall, 85–102.

ACER 1996: *Quest programme* (Computer software). Melbourne, Australia: Australian Council for Educational Research (ACER).

Alderson, J.C. 2000: *Assessing reading*. Cambridge: Cambridge University Press.

Alexander, P.A., Graham, S. and **Harris, K.R.** 1998: A perspective on strategy research: progress and prospects. *Educational Psychology Review*, 10, 129–53.

Bachman, L.F. 1990: *Fundamental considerations in language testing*. Oxford: Oxford University Press.

Bachman, L.F. and **Palmer, A.S.** 1996: *Language testing in practice*. Oxford: Oxford University Press.

Baker, L. and **Brown, A.L.** 1984: Metacognitive skills and reading. In Pearson, P.D., editor, *Handbook of reading research.* New York: Longman, 353–94.

Brown, A.L. 1980: Metacognitive development and reading. In Spiro, R.J.,

Bruce, B.B. and Brewer, W.F., editors, *Theoretical issues in reading comprehension*. Hillsdale, NJ: Erlbaum, 453–81.

—— 1989: *A practical guide to language learning*. New York: McGraw-Hill.

Brown, A.L., Bransford, R., Ferrara, R. and **Campione, J.** 1983: Learning, remembering, and understanding. In Mussen, P., editor, *Handbook of child psychology: cognitive development*. 4th edition, volume 3. New York: John Wiley and Sons, 77–166.

Chamot, A.U., Küpper, L. and **Interstate Research Associates** 1989: Learning strategies in foreign language instruction. *Foreign Language Annals* 22, 13–24.

Chapelle, C.A. 1998: Construct definition and validity inquiry in SLA research. In Bachman, L.F. and Cohen, A.D., editors, *Interfaces between second language acquisition and language testing research*. Cambridge: Cambridge University Press, 32–70.

Cohen, A.D. 1994: *Assessing language ability in the classroom*. 2nd edition. Heinle & Heinle, Boston, MA.

—— 1998a: Strategies and processes in test taking and SLA. In Bachman, L.F. and Cohen, A.D., editors, *Interfaces between second language acquisition and language testing research.* Cambridge: Cambridge University Press, 90–111.

—— 1998b: *Strategies in learning and using a second language*. London and New York: Longman.

Cohen, J. 1977: *Statistical power analysis for the behavioral sciences*. New York: Academic Press.

Ellis, R. 1994: *The study of second language acquisition*. Oxford: Oxford University Press.

Ericsson, K.A. and **Simon, H.A.** 1993: *Protocol analysis: verbal report as data*. Cambridge, MA: MIT Press.

Faerch, C. and **Kasper, G.** 1983: *Strategies in interlanguage communication.* London: Longman.

Flavell, J.H. 1971: First discussant's comments: what is memory development the development of? *Human Development* 14, 272–78.

—— 1992: Metacognition and cognitive monitoring: a new area of cognitive-developmental inquiry. In Nelson, T.O., editor *Metacognition: core reading*. Boston, MA: Allyn and Bacon, 3–8.

Gagné, E.D., Yekovich, C.W. and **Yekovich, F.R.** 1993: *The cognitive psychology of schooling learning*. New York: Harper Collins College.

Hacker, D.J. 1998: Definitions and empirical foundations. In Hacker, D.J., Dunlosky, J. and Graesser, A.C., editors, *Metacognition in educational theory and practice*. Mahwah, NJ: Erlbaum, 1–24.

Hatch, E. and **Lazaraton, A.** 1991: The research manual: design and statistics for applied linguistics. Boston, MA: Heinle and Heinle.

Hong, E. 1998a: Differential stability of individual differences in state and trait test anxiety. *Learning and Individual Differences* 10, 51–69.

—— 1998b: Differential stability of state and trait self-regulation in academic performance. *Journal of Educational Research* 91, 148–58.

Kaylani, C. 1996: The influence of gender and motivation on EFL learning

strategy use in Jordan. In Oxford, R., editor, *Language learning strategies around the world: cross-cultural perspectives*. Honolulu, HI: University of Hawaii, Second Language Teaching and Curriculum Center, 75–88.

Kluwe, R.H. 1982: Cognitive knowledge and executive control: metacognition. In Griffin, D.R., editor, *Animal mind: human mind*. New York: Springer, 201–24.

Lynch, B.K. 1996: *Language program evaluation: theory and practice*. Cambridge: Cambridge University Press.

McNamara, T.F. 1996: *Measuring second language performance*. London and New York: Longman.

Messick, S. 1989: Validity. In Linn, R.L., editor, *Educational measurement*. 3rd edition. New York: Macmillan, 13–103.

—— 1996: Validity and washback in language testing. *Language Testing*, 13, 241–56.

Miles, M.B. and **Huberman, A.M.** 1994: *Qualitative data analysis: an expanded sourcebook*. Beverly Hills, CA: Sage.

O'Malley, M.J. and **Chamot, A.U.** 1990: *Learning strategies in second language acquisition*. Cambridge: Cambridge University Press.

O'Malley, J.M., Chamot, A.U. and **Küpper, L.** 1989: Listening comprehension strategies in second language acquisition. *Applied Linguistics* 10, 418–37.

Oxford, R. 1989: 'The best and the worst': an exercise to tap perceptions of language-learning experiences and strategies. *Foreign Language Annuals* 22, 447–54.

—— 1990: *Language learning strategies: what every teacher should know*. Boston: Heinle and Heinle.

Pitts, M.M. 1983: Comprehension monitoring: definition and practice. *Journal of Reading* 26, 516–23.

Politzer, R.L. and **McGroarty, M.** 1985: An exploratory study of learning behaviors and their relationship to gain in linguistic and communicative competence. *TESOL Quarterly* 19, 103–23.

Purpura, J.E. 1997: An analysis of the relationships between test-takers' cognitive and metacognitive strategy use and second language test performance. *Language Learning* 47, 289–325.

—— 1998: Investigating the effects of strategy use and second language test performance with high- and low-ability test-takers: a structural equation modeling approach. *Language Testing* 15, 333–79.

—— 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.

Schmidt, R. 1994: Deconstructing consciousness in search of useful definitions for applied linguistics. *AILA Review* 11, 11–16.

Schraw, G. 1998: Promoting general metacognitive awareness. *Instructional Science* 26, 113–25.

SPSS 1999: *SPSS Version 9.0* (Computer software). Chicago, IL: SPSS.

Weinstein, C.F. and **Mayer, D.** 1986: The teaching of learning strategies.

In M. Wittrock, editor, *Handbook of research on teaching*. New York: Macmillan, 315–27.

Wenden, A.L. 1991: *Learner strategies for learner autonomy*. Englewood Cliffs, NJ: Prentice-Hall.

Wilson, J. 2000: Assessing metacognition. Unpublished PhD dissertation, University of Melbourne, Australia.

Appendix 1 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).

Table 22

	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 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 by scanning and skimming.	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 understand the reading test.	1	2	3	4	5
10.	I tried to identify easy and difficult test components.	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 what and how I was doing in the test.	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

Appendix 1 Continued

	Your thinking	1	2	3	4	5
18.	I was aware of which strategy to use and how and when to use it.	1	2	3	4	5
19.	I would correct mistakes immediately when found.	1	2	3	4	5
20.	I asked myself how the test 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.	1	2	3	4	5
23.	I was aware of how much the test remained to be completed.	1	2	3	4	5
24.	I tried to understand the questions adequately before attempting to find the answers.	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.	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 the selected strategies to help me complete 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 relevant information to help me understand the reading texts and answer the test questions.	1	2	3	4	5
33.	I determined how to solve the test.	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.	1	2	3	4	5