

Assessing the Roles of Metacognitive Knowledge and Vocabulary Size in EFL Reading Comprehension

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Recent studies show that the influence of metacognitive knowledge on the second language reading increased with the increasing vocabulary knowledge. However, the relationship among metacognitive knowledge, language knowledge and EFL reading still needs to be further clarified. How does vocabulary knowledge make an independent contribution to L2 reading? How does it moderate the effect of metacognitive knowledge on L2 reading? This study assesses the roles of metacognitive knowledge and vocabulary size in EFL academic reading based on Chinese tertiary EFL learners. The participants include 548 non-English major sophomore students in mainland China. The instruments include a questionnaire on the metacognitive knowledge of EFL reading comprehension, Vocabulary Levels Test (Nation, 1990) and an EFL reading comprehension test. The findings reveal that Chinese tertiary EFL readers only approach 3,000-word level. Vocabulary size does not only exert direct influences on EFL reading comprehension ability, but also plays a significant moderating role in regulating the effect of metacognitive knowledge on EFL reading comprehension ability. When the vocabulary size reaches above the threshold of 3,000 words, metacognitive knowledge plays an increasing role in EFL reading comprehension ability. The theoretical and educational contributions of these findings for L2 academic reading are discussed.

Key words: vocabulary size, metacognitive knowledge, EFL reading comprehension, language threshold hypothesis, Chinese tertiary EFL learners

INTRODUCTION

While second language (L2) reading research has been largely influenced by studies conducted in first language (L1) reading research since 1970s, after 30 years' exploration researchers gradually realized that L2 reading is both a reading problem and a language knowledge problem rather than an either/or issue (e.g., Alderson, 1984; Bernhardt, 2005; Carrell, 1991; Cziko, 1980). Cummins' threshold hypothesis (1978, 1979) postulates that the transfer of literacy skills from L1 reading to L2 reading takes place only after a threshold level of L2 proficiency has been attained. Two major factors have been identified as responsible for L2 reading comprehension: L1 literacy and L2 language knowledge (Bernhardt, 2005). L1 literacy was assessed by different reading tasks measuring L1 global reading ability; readers' L2 knowledge was indicated as vocabulary knowledge or grammar knowledge; regression analysis was commonly adopted in assessing the contributions of these factors in L2 reading comprehension ability (Bernhardt, 2005; Bernhardt & Kamil, 1995; Brisbois, 1995; Carrell, 1991). Although L1 literacy and L2 language knowledge have been found to play significant roles in L2 reading comprehension, some problems still remain. Most studies have focused on cognate languages and have been based on younger children in primary and early secondary schools in western countries. Moreover, text-based features such as word knowledge and reader variables such as interest, self-perception and goal setting which are involved in L2 reading remain unexplored in these studies. Measures of L1 literacy and L2 language knowledge also need improving. A lot of such studies utilized L1 global reading comprehension ability tests which comprise L1 vocabulary knowledge and grammar knowledge as the indicator of L1 literacy. L2 language knowledge was only estimated, for example, on the instruction level when Carrell (1991) compared the contributions of L1 reading literacy and L2 proficiency in L2 reading. Finally, the relationship among L1 literacy, L2 language

knowledge and EFL reading comprehension needs to be further clarified. It is worth exploring how L2 language knowledge affects the transfer of L1 literacy from L1 reading to L2 reading.

In view of these problems, the study identifies metacognitive knowledge and vocabulary size to explore the roles of L1 literacy and L2 language knowledge in EFL reading comprehension. Metacognitive knowledge taps the commonality of reading ability underlying L1 and L2 reading comprehension and therefore encompasses L1 literacy transferred to L2 reading (Schoonen et al., 1998). Vocabulary size, an important dimension of vocabulary knowledge, is always considered as one of the most significant indicators of language knowledge in L2 reading (Anderson & Freebody, 1981; Bernhardt, 2005; Laufer, 1996; Qian, 2002). Schoonen et al. (1998) and van Gelderen et al. (2004) have utilized these two indicators to examine the relationships among L1 literacy, L2 language knowledge and EFL reading comprehension. However, there is no mention of the interaction between vocabulary knowledge and metacognitive knowledge in their studies. The construct of metacognitive knowledge remains doubtful. The questionnaire was constructed in terms of some “appropriate” ideas in the literature (Schoonen et al., 1998, p. 79), as the researchers claimed. A closer look at the question items revealed that some questions may not be relevant or appropriate to the assessment content. For example, in “assessment of oneself as a reader”, one of the questions read “How well can you infer the meaning of an unknown word?” This question seemed rather vague if without a concrete example. It may risk in students’ overevaluating their inference ability. When assessing “knowledge of reading goals and comprehension criteria”, one of the open-ended questions began as “when you begin to read a text, you would normally want to understand it well...” It already presumed a good understanding of reading purposes by these primary and secondary students. However, it is possible that some students at this age (grade 6) may regard decoding or verbatim recalling as one of their reading purposes.

In China, English reading for college courses places high cognitive processing demands on EFL learners in terms of its extensive reading amount, complex structures of text material, wide ranges of topics and differing varieties of tasks and purposes. China has the biggest number of EFL learners in the world. However, the

EFL reading research in the Chinese EFL context is quite disproportionate with its large number of EFL learners (Zhang, 2001).

The present study focuses on the Chinese tertiary EFL learners to assess the roles of metacognitive knowledge and vocabulary size in L2 academic reading comprehension. Three research questions were formulated.

- (a) What is the vocabulary size of the selected group of Chinese sophomore EFL readers?
- (b) How does vocabulary size affect EFL reading comprehension for the Chinese tertiary EFL readers?
- (c) How does metacognitive knowledge affect EFL reading comprehension for the Chinese tertiary EFL readers?

The study extends this line of research in the following ways. First, the study proposes a framework for examining the relationships among metacognitive knowledge, vocabulary size and L2 reading comprehension for tertiary-level Chinese EFL learners. Second, the study theorizes metacognitive knowledge in L2 reading comprehension as consisting of both cognitive and motivational elements. Specifically, the motivational characteristics such as self-perception, goal setting and interest are embodied in the conceptual framework of metacognitive knowledge. Third, the study explores both the direct and indirect influences of vocabulary size on EFL reading comprehension.

THEORETICAL FRAMEWORK

Theories of reading: process models and product models

Reading research can be classified into two categories: process models and product models (Urquhart & Weir, 1998). Process models focus on the actual process of reading. Three types of reading process models have been advanced in both L1 and L2 reading (Coady, 1979; Hosenfeld, 1984; Plaister, 1968; Rivers,

1964; Urquhart & Weir, 1998) . First came the bottom-up models (Gough, 1972; Rayner & Pollatsek, 1989) and then top-down models (Goodman, 1967; Smith, 1971), which was replaced by interactive models at a later stage (Rumelhart, 1977; Stanovich, 1980). Bottom-up models conceptualize reading primarily as a decoding of the text by the reader (Gough, 1972). By contrast, top-down models conceptualize reading as hypothesis testing by the reader (Goodman, 1967). The interactive model of reading combines top-down and bottom-up strategies for deriving meanings from the text (Perfetti, 1985; Singer & Ruddell, 1985; Ulijn, 1980; Waltz & Pollack, 1985; Weber, 1984). The meaning of the text is constructed by both the writer's text and the reader's interpretation. Stanovich (1980) developed interactive-compensatory model attempting to incorporate both skilled and unskilled reading into one model. The word "compensatory" suggests that "process at any level can compensate for deficiencies at any other level" (Stanovich, 1980, p. 36). The interactive model is considered the most appropriate for L2 readers who may have to, for example, draw on the contextual knowledge to compensate for a lack of sufficient language knowledge. Carrell has researched extensively on the role of background knowledge (or schema) in L2 reading theory (Carrell, 1983a, 1983b, 1983c, 1984a, 1984b, 1984c, 1985, 1987, 1988, 1989, 1990, 1998; Carrell & Eisterhold, 1983; Carrell, Gajdusek, & Wise, 1998; Carrell, Pharis, & Liberto, 1989). She pointed out that readers' metacognitive awareness of various types of reading strategies contributes to the transfer of strategies from L1 reading to L2 reading (1989).

Product models assess the construct of reading. Product models of L2 reading are basically oriented towards bi-divisible and multi-divisible views. The bi-divisible view describes L2 reading as consisting of L1 literacy and L2 language knowledge (Bernhardt & Kamil, 1995; Brisbois, 1995; Carrell, 1991). Bernhardt's three-dimensional compensatory processing model of L2 reading further clarifies L2 reading as three dimensions in nature with regard to L1 literacy, L2 language knowledge and unexplained variance in L2 reading (Bernhardt, 2005). The model highlighted vocabulary knowledge as one of the most significant indicators of language knowledge, parallel to the special features of L2 learning. The unexplained variance includes comprehension strategies, engagement, content and

domain knowledge, etc.

There does not exist a clear demarcation between the process approach and the product approach. Bernhardt (2005) admitted that she took up the notion of “compensatory” from Stanovich’s compensatory processing (1980) in that certain knowledge sources compensate for other inadequate or nonexistent knowledge sources. Thus the present study draws on the strengths of both process and product approaches to explore the academic reading performance of Chinese tertiary EFL readers. Based on the understanding that metacognitive awareness plays a significant role in process model and vocabulary knowledge in product model, the study identifies two components—metacognitive knowledge and vocabulary size to represent L1 literacy and L2 language knowledge respectively. Metacognitive knowledge is also utilized to explore the unknown areas such as motivation and comprehension strategies as specified by Bernhardt (2005). The study explores the relationship among metacognitive knowledge, vocabulary size and EFL reading comprehension.

Metacognitive Knowledge and L2 Reading Comprehension

Metacognition is the confluence of Piagetian developmental psychology and information processing theory (Flavell, 1979). Flavell, in his pioneering work, defined metacognition as “knowledge and cognition about cognitive phenomena” (1979, p. 906). Similarly, Nelson (1999, p. 625) described metacognition as “the scientific study of an individual’s cognitions about his or her own cognitions”. In general, metacognition involves thinking about thinking and cognition of cognition (Gredler, 1997; Hacker, 1998).

According to Flavell (1979), metacognitive knowledge includes three subcategories of variables: person, task and strategy variables. The person category embodies beliefs about oneself and others as cognitive processors. Task knowledge concerns how the variations in information available to people during a cognitive enterprise might affect people’s achieving goal. Strategy knowledge refers to knowledge about what strategies are likely to be effective in achieving what subgoals and goals in what sorts of cognitive undertakings.

In the following years researchers developed the notion by clarifying and specifying more content in each or related category (Alexander, Schallert, & Hare, 1991; Brown, Armbruster, & Baker, 1986; Pintrich, 2002). Alexander, Schallert, & Hare (1991) added a fourth dimension, knowledge of plans and goals, to Flavell's framework to address the affective understanding that learners have about themselves alone and in relation to others. Pintrich (2002) also noted that that self-knowledge includes self-knowledge and self-awareness about motivation such as self-efficacy, goals for completing a task, and the interest and value of the task, and the general self-knowledge of one's strengths and weaknesses.

Following Flavell's theoretical composition, the present study represents metacognitive knowledge in L2 reading as person, task and strategy variables. Specifically person knowledge refers to one's self-awareness of own reading strengths or weaknesses and how the motivational characteristics such as self-efficacy, goal setting and interest affect his/her own reading process. Task knowledge refers to L2 readers' knowledge about various task demands and purposes of reading. Strategy knowledge includes knowledge of strategies of how L2 readers plan, monitor and regulate their EFL reading. As task knowledge and strategy knowledge are related to each other and hard to distinguish (Vandergrift, 2006), they are merged into the category of strategy knowledge in operation in the present study.

Metacognitive knowledge involves not only what we know but also how we use this knowledge (Wenden, 1998). It enables readers to regulate deliberate efforts and apply executive control in efficient reading (Baker & Brown, 1984). Once activated in a specific context, it serves as a base and important source for learners to draw upon as they regulate and control their reading (Pintrich, Wolters, & Baxter, 2000). Schoonen, Hulstijn & Bossers (1998) assess the contributions of metacognitive knowledge and vocabulary knowledge to L1 (Dutch) and L2 (English) reading comprehension based on 685 students in grades 6, 8 and 10 in the Netherlands. The findings showed that the influence of metacognitive knowledge increased with increasing age for both L1 and L2 reading comprehension. For L2 reading comprehension, van Gelderen et al. (2004) also reported that both metacognitive knowledge and vocabulary knowledge contributed significantly to L2 (English)

reading comprehension based on 397 Dutch students from Grades 8 to 10.

The increasing influence of metacognitive knowledge on L2 reading comprehension seems to provide evidence for the threshold hypothesis which holds that a learner's reading ability cannot be transferred to L2 reading if his/her L2 language knowledge remains below a threshold level. That is, the learner's reading ability is short circuited by his/her low L2 proficiency. In Schoonen et al. (1998), metacognitive knowledge played a more significant role in grade 10 than in grade 8. This seemed to indicate that as students' language knowledge increases they are more capable of utilizing metacognitive knowledge.

However, there is no report on this "sufficient language knowledge" in the above-mentioned studies. According to the language threshold hypothesis, when there is sufficient vocabulary knowledge, vocabulary knowledge does not only exert direct influence on L2 reading comprehension, it may also affect L2 reading comprehension through its indirect relationship with metacognitive knowledge. Moreover, how does vocabulary knowledge make an independent contribution to L2 reading comprehension? How does it moderate the effect of metacognitive knowledge on L2 reading? These questions need to be further clarified.

Most studies based on the Chinese EFL learners focus on the relationship between metacognition, especially metacognitive knowledge, and EFL reading comprehension. The research findings are inconsistent. Zhang (2010) found a strong relationship between metacognition and successful EFL reading comprehension, and the successful L2 students differ from the less successful L2 students in the amount of the metacognitive knowledge they possess. However, Pang (2006) found that poor readers used more types of metacognitive knowledge than good readers.

Vocabulary Size and L2 Reading Comprehension

The research findings on the vocabulary-comprehension connection demonstrate a consistently significant relationship between vocabulary size and L2 reading comprehension (Laufer, 1992, 1996; Liu & Nation, 1985; Qian, 1999, 2002). Laufer (1992) found a correlation of .50 ($p < .0001$) between the scores on the

Vocabulary Levels Test (Nation, 1983) and reading comprehension on 92 first-year university students whose first language was either Hebrew or Arabic. Qian (2002) also found that vocabulary size could predict 54% of the total variance in L2 reading comprehension when the vocabulary size of the participants reached a minimum of 3,000-word level.

The threshold vocabulary in L2 reading comprehension has been translated into text coverage and vocabulary size (Laufer, 1992, 1996; Nation, 1990). Coady et al. (1993) claimed that approximately 2,000 high-frequency words are the basic need for a L2 learner to understand about 85% of the text. Nation (1993) states that 5,000 word tokens should provide a lexical coverage of over 95% of academic texts in English. When inflected forms and closely related derivatives are considered as one word type, the 5,000 words will be translated into 3,000 word families. Laufer (1992, 1996) suggested a vocabulary size of 3,000 word families and a coverage of 95% of the words in a text were the normal cutoff for an adequate reading. Taken together, researchers seemed to reach a consensus of around 3,000 word families as the threshold vocabulary for reading authentic texts in the target language.

In China, most studies focus on the vocabulary size of the tertiary-level students. Lv (2004) found that the vocabulary size of fresh people was 2,145 in a survey on 1,610 freshmen in one state-level science university in southwestern part of China. Shao (2002) surveyed first and second year students from three normal universities and found that freshmen had a start-up vocabulary size of 2,574 words and their vocabulary size increased to 3,811 words at the end of the second year. Zhou & Wen (2000) conducted research on the vocabulary size of a group of science students. The students' vocabulary size at the entrance of the university was 2,404 and increased markedly during the first two years to a level of 3,818 at the end of the second year. All these studies were based on the self-made tests. Little has been reported concerning the reliability and validity of these tests. A standardized test such as Nation's Vocabulary Levels Test (Nation, 1990) should provide more convincing and accurate figures.

RESEARCH DESIGN

Participants

The participants consisted of 548 non-English major sophomores who entered four universities in mainland China in the fall of 2006, of whom 434 (79.2%) were science majors and 114 (20.8%) were majoring in the Liberal Arts. The four universities were all first-class universities in China, with one ranking among the top 10 in China. The sample consisted of 334 (60.9%) male students and 214 (39.1%) female students. Their age ranged from 17 to 22 ($M=19.55$, $SD=.86$). The students were all required to take English courses as part of their degree programs.

INSTRUMENTS

Measure of metacognitive knowledge: Questionnaire on the Metacognitive Knowledge of EFL Reading Comprehension

Questionnaire on the Metacognitive Knowledge of EFL Reading Comprehension consists of two parts. Part One includes questions about personal information such as name, age, gender and department. Part Two consists of two categories of metacognitive knowledge: person knowledge and strategy knowledge. All the questionnaire items are rated on a five-point likert scale.

The construction of the questionnaire items comes from two sources: (1) an earlier think-aloud study which elicits and identifies the types of metacognitive knowledge utilized by the Chinese tertiary EFL readers (Li, 2008); (2) the existing questionnaires in the relevant areas.

The items for strategy knowledge include 4 factors, three of which were from Metacognitive Awareness of Reading Strategies Inventory (MARSIS) which was used to assess adult ESL readers' metacognitive awareness of reading process while reading academic or school-related materials (Mokhtari & Reichard, 2002). The choice of MARSIS is out of the consideration that many of the MARSIS items could be found in the identified metacognitive types utilized by Chinese tertiary EFL

readers in the earlier study (Li, 2008). The three factors from MARSII are Global Reading Strategies which are oriented toward a global analysis of text (e.g., “I decide what to read closely and what to ignore.”), Problem-Solving Strategies aiming at solving problems when the text becomes difficult to read (e.g., “When the text becomes difficult, I reread to increase my understanding.”) and Support Reading Strategies which primarily involve the use of outside reference materials, taking notes, and other practical strategies (e.g., “I underline or circle information in the text to help me remember it.”). The fourth factor, Mental Translation Strategies which concerns the translation of some portions of the text from L2 to L1 in order to facilitate understanding, was most frequently adopted metacognitive types by the Chinese tertiary EFL readers according to the earlier findings (Li, 2008) (e.g., “I translate every sentence into Chinese during reading.”).

Items for person knowledge were constructed around four major areas identified from the earlier findings (Li, 2008) and adapted from Attitude Questionnaire (Yamashita, 2007) and Motivation for Reading Questionnaire (MRQ) (Wigfield & Guthrie, 1997): Interest in which readers show interest or curiosity in the topic or text content (e.g., “I enjoy reading books in English about people in different cultures.”), Self-efficacy in which readers perceive their own ability of performing the reading task (e.g., “I think my reading ability is advanced.”), Performance goal in which readers read for their academic goals (e.g., “Reading English is advantageous to the study of my major.”) and Learning goal in which readers read for the purpose of understanding another culture or increasing their competence (e.g., “Reading English enables me to acquire depth of knowledge.”).

The questionnaire was initially developed in English and was first translated into Chinese by the researcher and then revised by a PhD student who specializes in Psychology to avoid possible misapprehensions due to the possible language barrier. The Chinese version was back translated into English by one teacher of English at the tertiary level. Two teachers of English were invited to compare the back translation with the original English and points of divergence were noted on 5 items. Revisions were made then to make the translation more accurately reflect the original meaning.

The reliability for the overall scale of the questionnaire was .875. For strategy knowledge, the reliability was .806 (Global Reading: .713; Problem-solving: .563;

Support Reading: .575; Mental Translation: .624). The reliability for person knowledge was .851 (Interest: .677; Self-efficacy: .742; Learning Goal: .751; Performance Goal: .694). Table 1 summarizes items for each dimension and their respective reliability.

TABLE 1
Reliabilities of Eight Dimensions of Metacognitive Knowledge

Metacognitive knowledge	Items	Number	Alpha
Strategy knowledge		34	.806
•Global reading	1,5,7,11,16,20,24,28,34,35,39,40,45	13	.713
•Problem-solving	13,17,22,25,30,31,42,47	8	.563
•Support reading	2,9,10,14,18,21,29,37,43	9	.575
•Mental translation	3, 15,26, 46	4	.624
Person knowledge		15	.851
•Interest	4, 36,41, 49	4	.677
•Self-efficacy	8,12,19,33	4	.742
•Learning goal	6,23,27,48	4	.751
•Performance goal	32,38,44	3	.694

Measure of Vocabulary Size: Vocabulary Levels Test

Nation's Vocabulary Levels Test (Nation, 1990) was used to measure the vocabulary size of the Chinese EFL readers in the present study. The test has been extensively adopted as a measure of vocabulary size for L2 readers (Laufer, 1992, 1996; Qian, 1999, 2002; Yu, 1996). The test is composed of five parts representative of five different vocabulary size levels for EFL learners: the 2,000-word level, the 3,000-word level, the 5,000-word level, the University word level and the 10,000-word level. The 2,000- and 3,000-word levels refer to high-frequency words; the 5,000-word level includes words on the boundary of high- and low-frequency; the University word level represents specialized vocabulary of university texts for tertiary learners; the 10,000-word level consists only of low-frequency words.

For each word level there are six sets of vocabulary items, each with six selected words and three definitions. Each level contains 18 correct choices to represent all

the words at that level. The test-takers are requested to choose 3 out of 6 words to match the three definitions, as illustrated below.

- | | |
|-------------|--|
| 1. coach | |
| 2. darling | <u>6</u> a thin, flat piece cut from something |
| 3. echo | <u>2</u> person who is loved very much |
| 4. interior | <u>3</u> sound reflected back to you |
| 5. opera | |
| 6. slice | |

(Source: Nation, 1990)

When scoring the test, one score is given for each correct matching. The maximum possible score for each level is 18. A score of 12 or less out of 18 suggests that one-third or more than one-third of the words at that level are not known to the test-taker. In other words, this level has not been mastered.

Measure of EFL Reading Comprehension Ability: EFL Reading Comprehension Test

The EFL reading comprehension test adopts test types in compliance with the reading part of the national College English Test Band Four Test which is a required test for university degrees in many Chinese universities. The EFL Reading Comprehension Test consists of two parts. Part One contains a passage ranging from 600-800 words. The test takers are requested to write Y (for YES), N (for NO) and NG (for NOT GIVEN) for the 7 statements following the passage. Part Two is composed of 2 passages with 4 or 5 multiple-choice questions following each text respectively. One point is given for each correct answer. The test difficulty was set at the CET-4 level and was reviewed by an expert who specializes in reading teaching and research at the tertiary level for over 20 years. The reliability of the test was .805.

Data Collection

Students from four different universities in mainland China completed the questionnaire and tests in October 2007. The questionnaire and the two tests were administered to the participants at the presence of their teachers of English during the normal class periods at two individual sessions in case that too many materials at once might fatigue the students. The questionnaire was administered to the students in the first session. This was followed by the Vocabulary Levels Test in the same session. A maximum of 30 minutes was allowed for the test. The EFL Reading Comprehension Test was administered to the students in the second session with a time limit of 35 minutes. The researcher explained the purpose of the survey to the students and emphasized that the results would only serve research purposes and would not be included in their academic record. The students were allowed to decline or drop out in the middle during the tests. As the data were collected at different times, some students were absent in class and did not complete all the questionnaire and tests. Due to the absence of some students at two different sessions and some uncompleted questionnaires or tests, some data were unusable. After the elimination of these unusable data, 548 students formed the final pool for data analysis.

Data Analysis

Descriptive statistics for the participants' vocabulary size were provided. Regression analysis is the major analysis to examine the relationships among metacognitive knowledge, vocabulary size and EFL reading comprehension ability. The single contribution of vocabulary size to EFL reading comprehension was examined. Following this, the contribution of each type of metacognitive knowledge to EFL comprehension below and above the threshold vocabulary was computed.

FINDINGS

Vocabulary Size of Chinese Tertiary Students

Table 2 presents the descriptive statistics for the five word levels on Vocabulary Levels Test (Nation, 1990). The students had a vocabulary level of two thousand words and only approached the 3,000-word level. Among them 269 students scored 3,000 words or above. They understood about 85% of the first two thousand words and 67% of the third thousand words. The figures for the other three word levels dropped drastically. For 5,000- and university word levels, the students only knew 34% and 30% of the words respectively at each level. It was understandable that at 10,000-word level the students knew only 17% of the words and none of the students have scored up to 13. The range for each word level was very wide, from the students who had a full score at the word level (18) to those who scored very low (2 or 5) or even zero.

TABLE 2
Descriptive Statistics of the Vocabulary Size of Chinese Tertiary EFL Readers

	<i>M</i>	Min.	Max.	Mode	<i>SD</i>	≥ 13		≤ 12	
						Frequency	%	Frequency	%
VOC 2,000 (85%)	15.28	5	18	17	2.33	484	88.3	64	11.7
VOC 3,000 (67%)	12.00	2	18	13	3.56	269	49.1	279	50.9
VOC 5,000 (34%)	6.17	0	16	6	2.94	16	2.9	532	97.1
VOC UNI (30%)	5.40	0	16	5	3.12	17	3.1	531	96.9
VOC 10,000 (17%)	3.08	0	12	0	2.30	0	0	548	100

Relationships among Vocabulary Size, Metacognitive Knowledge and EFL Reading Comprehension

The regression analysis was first performed to examine the instrumental effect of

vocabulary size alone on EFL reading comprehension. The sum score of all the five levels on Vocabulary Levels Test was entered into the equation as the independent variable. Vocabulary size was found to be a significant predictor of EFL reading comprehension, explaining about 19% of the total variance of EFL reading comprehension ($p < .001$).

Then the effect of metacognitive knowledge on EFL reading comprehension with vocabulary size as the moderator was examined. The study explores how the participants' metacognitive knowledge affects their L2 reading comprehension ability in two vocabulary size groups with one group of or above the language threshold of 3,000 words and the other below 3,000 words. The eight dimensions of metacognitive knowledge under the two major categories — strategy knowledge (Global Reading strategies, Problem-Solving strategies, Support Reading strategies and Mental Translation strategies) and person knowledge (Interest, Self-efficacy, Learning goal and Performance goal) constitute the independent variables. Regression analysis was performed respectively for each independent variable to examine the relationships among metacognitive knowledge, vocabulary size and EFL reading comprehension.

Table 3 summarizes the results of regression analysis results. The findings revealed that vocabulary size played a very important role in moderating the effect of metacognitive knowledge on EFL reading comprehension. Below the 3,000-word level, except Mental Translation strategies none of the metacognitive components were found to be a significant predictor of EFL reading comprehension ability. By contrast, when the participants' vocabulary size reaches above the threshold of 3,000 words, metacognitive knowledge plays a much more important role. The moderating effect of vocabulary size for person knowledge was impressive when vocabulary size reaches above 3,000 words. Of all the four dimensions of person knowledge, three components including Interest ($p = .001$), Self-efficacy ($p < .001$) and Learning goal ($p = .024$) have exerted significant influences on the EFL reading comprehension. The effect of Support Reading strategies ($p = .055$) and Global Reading strategies ($p = .073$) on EFL reading comprehension have approximated the significant value respectively. The effect of Mental Translation strategies was found to be significant for both vocabulary size

groups. For Problem-Solving strategies, however, the effect remained insignificant even for the students who have mastered 3,000 words.

TABLE 3
Relationships among Metacognitive Knowledge, Vocabulary Size and EFL Reading Comprehension

Variable	Voc size	R	Adjusted R ²	R ²	F	Beta	t	Sig.
Global reading	≥3,000	.110	.008	.012	3.242	.541	1.801	.073
	<3,000	.050	-.001	.002	.681	.209	.825	.410
Problem-solving	≥3,000	.065	.001	.004	1.150	.340	1.072	.285
	<3,000	.026	-.003	.001	.187	.108	.432	.666
Support reading	≥3,000	.117	.010	.014	3.714	.552	1.927	.055
	<3,000	.005	-.004	.000	.007	.021	.086	.931
Mental translation	≥3,000	.130	.013	.017	4.605*	-.387	-2.146	.033
	<3,000	.172	.026	.030	8.487***	-.495	-2.913	.004
Interest	≥3,000	.207	.039	.043	11.907****	.622	3.451	.001
	<3,000	.018	-.003	.000	.094	.052	.306	.760
Self-efficacy	≥3,000	.226	.048	.051	14.401****	.746	3.795	.000
	<3,000	.068	.005	.005	1.272	.204	1.128	.260
Learning goal	≥3,000	.138	.015	.019	5.160*	.397	2.271	.024
	<3,000	.063	.000	.004	1.087	-.160	-1.043	.298
Performance goal	≥3,000	.082	.003	.007	1.804	.214	1.343	.180
	<3,000	.030	.001	.001	.252	.066	.502	.616

* $p < .05$, *** $p < .005$, **** $p < .001$

DISCUSSION

Regarding vocabulary size, the present findings presented a different picture from the previous findings which usually claimed a vocabulary size of more than

3,000 words for the second-year non-English major students in China (Shao, 2002; Zhou & Wen, 2000). The difference may have to do with the instruments of vocabulary size. Although the previous studies displayed a much larger vocabulary size than those in other countries, almost all of them were based on the self-made tests and little has been reported concerning the reliability and validity of the test. The findings from this study which adopts Nation's Vocabulary Levels Test could provide more convincing and accurate figures.

The students in the study had difficulties in both high-frequency and academic words. After seven years' formal school education, the participants' academic word number totals only one third of the necessary. The latest college English Curriculum requirements (for trial implementation) (2007) set three levels of requirements for undergraduate college English teaching, i.e., basic requirements, intermediate requirements, and higher requirements. The recommended vocabulary for the three levels is 4,795 words, 6,395 words and 7,675 words respectively. In this sense, most participants in the present study have not reached the minimum level of vocabulary that all non-English major undergraduates have to reach before graduation. In China the first two years of university study usually see a rapid growth of vocabulary size and the present test was held at the second year. However, the findings revealed a not very optimistic situation.

One of the most revealing findings from the present study is that vocabulary size not only makes an independent contribution to EFL reading comprehension, but also fosters the effect of person knowledge on EFL reading comprehension. The increasing vocabulary size is helpful in developing students' interest in reading, making them more efficacious at their own reading ability and more engaged in mastering the reading task and comprehending the text completely. Above the threshold vocabulary, the participants' self-knowledge about interest, self-efficacy and learning goal could play important facilitative roles in their EFL reading. They are more involved in the reading task, enjoy dealing with reading difficulties and remain task focused in face of comprehension failures.

The study provides evidence for the language threshold hypothesis. Overall the components of metacognitive knowledge could be transferred to L2 reading comprehension ability given that the vocabulary size reaches above the threshold

level. Vocabulary size not only demonstrated significant contributions to L2 reading comprehension alone but also moderated the effect of metacognitive knowledge on L2 reading comprehension. The study found that metacognitive knowledge played an increasing role in predicting L2 reading comprehension when vocabulary size reaches above the threshold of 3,000 words. Above the 3,000-word level, both vocabulary size and metacognitive knowledge could contribute significantly to EFL reading comprehension.

The findings also provided evidence for the claim that the cultural background of learning always constrains the way of learning. The effect of problem-solving strategies was discovered to be insignificant for both vocabulary size groups. This dimension involves reading-aloud and rereading strategies which were extensively used by the Chinese EFL learners with different reading ability. The students in the Chinese EFL context have been inculcated the habit of reading-aloud and re-reading since they received school education. Reading-aloud to them was more a habit rather than a problem-solving approach. This might be one of the reasons why this metacognitive component did not exert significant influences on EFL reading comprehension for different vocabulary size groups.

Mental Translation strategies were found to be significant for both groups. This is not without our expectation. For one thing, the grammar-translation method is still very popular for pre-university education. Influenced by the instructional style, it is no wonder that the students often regarded translation as one important criteria to judge their comprehension. The students may also use their L1 to reduce their anxiety and enhance their confidence in their reading process (Seng & Hashim, 2006). For another, translation could be indicative of both deep processing and superficial processing of the text. In terms of deep processing, translation could be regarded as the further efforts of processing the text following the understanding of the text to develop a solid conceptual framework for participants with 3,000 words or above. At the same time, translation could also be utilized as a superficial mapping between languages which only adds to the processing burden. It turned out to be indicative of bottom-up approach in this sense for participants with less than 3,000 words. Their reading is still far from fluent and they have to rely on the surface mapping between the two languages to establish meanings between words

though such translation is usually inefficient for developing a mental framework.

This study clarifies the concept of metacognitive knowledge by including in it the motivational and affective characteristics. Different from the previous research which focuses mainly on the cognitive aspect of metacognitive knowledge, the present study represents metacognitive knowledge as both strategy knowledge and person knowledge which refers to the self-knowledge about own strengths and weaknesses and motivational beliefs. While reconfirming the important role of strategic aspect of metacognitive knowledge in EFL reading comprehension, the study also discovers that self-knowledge about motivational beliefs could also exert great influences on EFL reading comprehension ability.

CONCLUSION

This study set out to investigate how Chinese tertiary-level EFL readers utilize their metacognitive knowledge in their EFL reading process as well as to clarify the relationships among metacognitive knowledge, vocabulary size and EFL reading comprehension ability. Vocabulary size does not only exert direct influences on EFL reading comprehension ability, but also moderates the effect of metacognitive knowledge on EFL reading comprehension. The study reveals that metacognitive knowledge plays an increasing role in EFL reading comprehension ability when the vocabulary size reaches above the threshold of 3,000-word level. Below the threshold of 3,000 words, almost none of the metacognitive components were found to be the significant predictor of EFL reading comprehension ability except Mental Translation Strategies. Above the threshold of 3,000-word level, three person knowledge components - Interest, Self-efficacy and Learning goal have exerted significant influences on EFL reading comprehension ability. The effects of Support Reading Strategies and Global Reading Strategies also approximated the significant value.

The findings have important implications for the Chinese EFL teachers who usually acknowledge the single linear relationship between vocabulary size and EFL reading comprehension. A better understanding of the relationships among the

language, cognitive and affective factors may prepare teachers with more efficient guidance on the students. The growth of vocabulary size strengthens the link between motivational characteristics and EFL reading. For one thing, interest is the interaction between an individual and a particular content (Hidi & Renninger, 2006; Krapp, 2000). The vocabulary size could define the direction of interest and contribute to its development in promoting reading comprehension. Vocabulary size functions more than a language component in EFL reading comprehension.

The findings reveal that the students are still struggling with vocabulary in both its knowledge and skill dimensions. In terms of vocabulary knowledge, the teacher may address the word frequency to help students enlarge vocabulary size. Specific emphasis should be given to the university academic words. Flexible strategic approaches should be adopted to address the vocabulary gap. For example, when students encounter an unknown word, the teacher may ask the students to first judge whether the unknown word is important to their understanding and then decide on whether the unknown word is worth their efforts.

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