The Relationship between English Proficiency Levels and EFL Students'

Cognitive Operations on Reading Comprehension

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Abstract

With the fermentation of globalization and the arrival of the age of information explosion, English reading ability, being of influentially international language, has been burgeoned an indispensable instrument not only for communicating with people, but also for seeking out more opportunities of employment. The purpose of this study was to investigate the relationship between English proficiency levels and their cognitive reading operations in terms of identifying main ideas, locating details, and making inferences. Subjects in the present study were 120 students, majoring in English at I-Shou University.

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Both quantitative questionnaire survey and qualitative research methods were used in this study by employing a one-way analysis of variance (ANOVA), a correlation analysis, and a semi-structured interview technique to explore subjects' perceptions toward their usage of cognitive operations. The research results reveal that high-level students scored significantly higher than low-level students in identifying main ideas and locating details; however, there was no significant difference between students' proficiency levels and their cognitive operations. Regarding the relationship between students' reading scores and their usage of cognitive operations, it shows that students with higher reading scores had better reading performance in their application of cognitive operations in terms of identifying main ideas and locating details. Based on the research results, it is expected that the research results can provide EFL reading teachers with pedagogical implications to fully understand students' cognitive operations in their reading process, in order to promote students' English reading comprehension.

Keywords: Cognitive operations; identifying main ideas; locating details; making inferences; EFL reading proficiency

英語能力與閱讀理解中認知操作之關係

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摘要

　　隨著全球化現象的發酵及資訊爆炸時代的來臨，對於具有影響力的國際語言—英語閱讀能力，已逐漸萌芽並茁壯成一項不可或缺的工具。擁有英語閱讀能力，不僅是為了與人溝通，更增添許多未來就業的機會。本研究的主旨在於探討學生的英語能力及其認知操作（擷取大意、找出細節、產生推論）之間的關係與差異性。本研究採用質化及量化的研究方法，其中包含了單因子變異數分析、相關分析及半結構式訪談，來檢測一百二十位義守大學應用英語學系學生的英語能力及其認知操作之間的關係。根據本研究結果顯示，在擷取大意及找出細節方面，英語能力高的學生相較於英語能力低的學生，有顯著性的差異。但是，在產生推論方面，英語能力高低則與學生的認知操作之間沒有顯著性的差異。

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　　至於學生的英語閱讀表現與其認知操作之間的關係，從研究結果中發現，在擷取大意及找出細節方面，對於閱讀能力較高的學生，其認知操作的應用有較好的表現。然而，對於產生推論方面，閱讀能力的高低則與學生的認知操作沒有顯著性相關。本研究結果將提供英語教育者瞭解不同英語程度學生，在其閱讀過程中所使用的各種認知操作，以達到提升學生英語閱讀理解力的目標。

關鍵字：認知操作、擷取大意、找出細節、產生推論、英語閱讀能力

Introduction

With the development of international globalization and the proliferation of populations learning foreign languages, the proficiency level of English, an international language, has evolved into one of the important instruments to compete for better jobs (Chen & Shang, 2009). Moreover, the evaluation of English proficiency level is prone to adopt paper-and-pencil tests as the ability indicator, so students' English reading comprehension ability has become an indispensable need to be ameliorated (Alsamadani, 2009). Also, reading is of great importance for learners in learning English language and gaining knowledge in daily lives (Alsamadani, 2009; Zhang, 2008).

However, many students have difficulties in reading because reading involved a plethora of variables is a complicated process not only integrating bottom-up, top-down, and interactive reading process (Goodman, 1988), but also activating prior knowledge, decoding word meaning, addressing assertion, as well as monitoring and regulating their cognitive reading operations (Yazdanpanah, 2007). What is more, EFL reading regarded as a passive and bottom-up process for a long time, is preliminarily a decoding phase of reconstructing the meaning of a text via identifying the detailed information, letters and words, and further understanding the larger units, phrases and sentences (Zhang, 2008). In other words, when reading a text,

EFL readers need to possess the abilities of identifying main ideas, locating details, and making inferences. Thus, in order to be a successful reader, the important prerequisites for students are to possess good vocabulary skills and background knowledge that they have experienced (Alber & Foil, 2003).

Previous studies further demonstrate that there are different performances between good and poor readers in terms of identifying main ideas and generating inferences (Chen, 2006). Chen discovers that poor readers are devoid of abilities to distinguish main ideas from illustrative contexts; on the other hand, good readers are apt to utilize the inference-making skills of reading strategies to answer the questions correctly in the reading comprehension test. Based on the recent research findings, it is shown that students' English proficiency levels go hand in hand with components of their cognitive operations in terms of identifying main ideas, locating details, and making inferences while reading English texts (Barry & Lazarte, 1998; Cain, Oakhill, Barnes, & Bryant, 2001; Carrel, 1992; Commander & Stanwyck, 1997; Hammadou, 1991; Meneghetti, Carretti, & De Beni, 2006; Pang, 2008; van den Broek, Fletcher, & Risden, 1993).

Although investigations of EFL reading comprehension in cognitive reading process have identified the different performances conducted by good and poor readers (Barry & Larzarte, 1998; Carrel, 1992; Commander & Stanwyck, 1997; Hammadou, 1991; van den Broek et al., 1993), most of the researches aim at L1 reading comprehension; that is, fewer studies focus on

EFL learners' reading proficiency in a Taiwanese learning context. To examine whether EFL readers' cognitive operations in terms of identifying main ideas, recalling details, and making inferences are related to their language proficiency, the purpose of this study is to investigate the relationship between students' English proficiency levels and cognitive operations, and further to explore students' attitudes toward their reading cognitive operations. Three research questions are addressed as follows:

Is there a significant difference among students with different proficiency levels on their usage of cognitive operations in terms of identifying main ideas, locating details, and making inferences?

What is the relationship between students' English proficiency levels and their usage of cognitive operations?

What are students' perceptions toward their application of cognitive operations in reading comprehension?

Literature Review

Reading, a language process to receive and acquire knowledge, is a psycholinguistic process that begins with a linguistic representation composed by writers and ends with the meaning of a text comprehended and constructed by readers (Goodman, 1988). To enhance the reading

comprehension ability in English, Alfassi (2004) stated that students should "understand the meaning of text, critically evaluate the message, remember the content, and apply the new-found knowledge flexibly" (p. 171). To train EFL readers to apply effective reading strategies, numerous researchers propose bottom-up, top-down, interactive, and SQ3R models to enhance learners' understanding of the text structure and to be capable of identifying and generating the main idea of a text (Gove, 1983; Paron, 1997; Shang, 2002). There are many researchers probing the characteristics of good readers consisting of peculiarities, natures, and processing manner. According to Hammadou (1991), he proposed that the more proficient readers not only understand the meaning of a text, but also comprehend more than of what they read. The same findings confirming with Nassaji's (2003) studies reveal that good ESL readers being proficient in word recognition skills have more efficient lower-level decoding skills than less-skilled readers. Moreover, proficient readers have better performance in processing the text. In the light of Pang's (2008) allegation, he mentioned that good ESL readers perform well in reading comprehension because they are able to process more sophisticated and ambiguous sentences. Confirmed with Pang, in Liu and Bever's study (as cited in Pang, 2008), they ascertained that good EFL readers are capable of processing sentences in a fast and subconscious mode due to their high language proficiency. What is more, good readers are those who are either aware of the discourse organization of a text, in order to

facilitate their reading process for recalling information or comprehend the pattern of a text better (Carrell, 1992).

In addition, good readers have some common peculiarities during their reading process. Based on Cain et al.'s (2001) study, they contended that readers with good comprehension skills not only acquire novel information from a text easily, but also structure the reliable and integrated representations for the sake of strengthening their working memory of knowledge domain. Furthermore, during reading process, good readers can also improve their comprehension without relying on phonological intervention or grapheme-phoneme conformation. Additionally, good readers make use of their schema (prior knowledge) as well. In Haenggi and Perfetti's (1992) study, they advocated that proficient EFL readers are capable of incorporating their schema with practical information they learned during processing the text. Moreover, as successful EFL readers, they guess less and read extensively in order to facilitate a text transformed into a meaningful context (Parry, 1991). What is more, in Meneghetti et al.'s (2006) study, they declared that good readers make the best of reading strategy to illuminate a mental model for enhancing their reading comprehension. Thus, good readers utilizing prior knowledge either integrate information or monitor their understanding efficiently (Pang, 2008).

On the other hand, according to Meneghetti et al.'s (2006) representation,

they conveyed that poor readers have average intelligence quotient relative to good readers, but they encounter difficulties in understanding the meaning of a text. They also reconfirm that less skilled readers are unable to process sentences due to lack of a successive working memory. What is more, poor readers are restricted by their cognitive strategy use due to their poor language competence, so as to influence their reading comprehension (Pang, 2008). In addition, poor readers are weak in reading comprehension during their reading process. According to Grabe and Stoller's study (as cited in Pang, 2008), it proposed that poor L2 readers are weak in word recognition and less proficient in spontaneous sentence processing because they are still developing their knowledge of grammatical structures. The same finding confirmed by Kirby's research (as cited in Amer & Khouzam, 1993), indicated that poor EFL readers not only are deficient in both word recognition and encoding meaning of a text, or lack of motivation to improve themselves. What is more, Cain et al. (2001) demonstrated that poor readers restricted by accessible information in their prior knowledge construct discrete representation of a text. Namely, poor readers are capable of combining information in a basic level, yet they can not integrate an overt and coherent model in a text. Such findings confirm with Meneghetti et al.'s (2006) and Lu's studies (as cited in Pang, 2008), indicating that poor readers regarded as misusing their prior knowledge to compensate for their language deficiencies are impotent in their reading process because of their inability to

either incorporate new information with their prior knowledge or derive from long-term memory. In a word, poor readers characterized by an ineffective reading process are less proficient in extracting main themes from irrelevant information; moreover, less skilled readers, characterized by unavailable outcomes, constitute a mental model which is less cohesive and approachable during the reading process (Gernsbacher et al., 1990).

Discriminations of Cognitive Operations between Good and Poor Readers

Identifying Main Ideas. The ability of identifying main ideas has been regarded as a test to delineate poor and good readers' reading comprehension (Wang, 2009). According to previous studies, poor readers are found to have difficulties in using appropriate strategies to identify main ideas. In Stevens's (1986) study, the purpose of this research was to examine the relative effectiveness of reading methods for teaching remedial students how to identify the main ideas of an expository text. Fifty-six students recognized as deficiency in identifying main ideas by a measurable skill were selected into this study. The criterion for the measureable skill was decided as the score among 6% correct or less on 10 questions which testify the ability to identify main ideas. An experimenter-designed criterion referenced test was employed,

which functioned as a pretest. The result revealed that limited effectiveness assists with these less-skilled readers (reading remedial students) because it was difficult for them to utilize reading strategies in identifying main ideas which include both cognitive classification and organization skills. Moreover, in Palincsar and Brown's (1984) study, poor readers encounter difficulties in integrating information to obtain the overall gist or main ideas of a passage. In Palincsar and Brown's research, 37 seventh-grade students including 24 students with reading problems (poor readers) and 13 students without reading problems (good readers) participated in this study. Thirteen passages averaging 1,500 words in each length were materials for subjects to examine their reading comprehension. The result showed that poor readers were unable to combine the information of a text to constitute the gist and main idea in experimental methods including summarizing, predicting, and detecting incongruities.

In addition, good readers are sensitive to what the content is important, to what they cover in the summary, and to how they transcribe the original text, thus acquiring the main ideas of a text when summarizing a text (Winograd, 1984). In Winograd's research, the purpose of this study was to examine the possibility that some eight-grade students encountered difficulties with the task of summarization linked to lack of strategic skills. One hundred and twenty subjects consisting of 80 eighth-grade students and 40 adults took part in this study. Subjects whose scores were below the 50%

on the Reading Comprehension Subtest of the Stanford Achievement Test
were identified as poor readers; yet subjects whose scores were above 59 %
on the same test were defined as good readers. A systematic reading
examination was employed to scrutinize students' reading performance in
terms of whether they were able to identify important elements in the text, to
transform the text into its gist, and to examine their introspective awareness
of the summarization. The result showed that most students were aware of
how to summarize a text, yet they either had difficulties in discriminating the
important information from a text, or failed to summarize a text into the main
idea or gist; nonetheless, good readers can identify the important information
and summarize a text into main ideas because they are more aware of what
the important content is, so as to acquire the main idea successfully instead of
locating additional supporting ideas.

Locating Details. Except for the discrimination of identifying main ideas,
locating details is another distinction shown between good and poor readers.
According to Tal, Siegel, and Maraun (1994), they confirmed that poor
readers perform worse than normal-achieving readers in locating details. The
purpose of this study was to investigate whether students with different
proficiency levels consisting of normal-achieving readers, poor readers with
no decoding disability, and reading-disabled poor readers with poor decoding
skills, differed in their abilities to deal with reading comprehension tasks

composed of passage independent, inferential, and locating questions. One hundred and sixty-one students including 36 females and 125 males categorized into three groups were invited to participate in this study. All subjects were designated to take an exam including three types of questions belonging to the reading comprehension task demand of this study. The result revealed that poor readers' average score, 66.63, was lower than normal-achieving readers' average score, 85.38. In a word, poor readers encounter difficulties in locating the explicit details of content areas in a text because they lack of sufficient retention. What is more, according to Cheng and Good's (2009) research, it indicated that it is difficult for less proficient L2 readers to locate specific details of a text because of a plethora of unknown vocabulary interfering students' understanding of a text. Thus, if EFL readers' lack of retention and quantity of vocabulary, they can not be proficient in locating specific details of a text.

Making Inferences. According to van den Broek et al. (1993), they proposed that "a central component of successful reading comprehension is the generation of inferences based on the information that is provided by the text" (p. 169). According to Cain et al.'s (2001) research, the purpose of their study was aimed at investigating the relation between young children's comprehension skill and inference-making performance. Twenty-six children, 13 children per group, took part in this study. They were requested to read a series of short stories out loud, and answer the inference questions. The

findings revealed that (1) poor readers generated fewer inferences than the good readers did; (2) poor readers often failed to integrate and remember the information when they generated the inferences because they not only employed the different standard wrongly for cohesion of a text, but also were less sensitive to discover whether an inference was necessary or not. Moreover, the same assertion confirmed by Cain and Oakhill's (1999) study was oriented toward investigating the relation between inference making and reading comprehension failure in young children. One hundred and twenty-nine subjects participating in this study were tested individually. After reading each story, subjects were asked with approximately four to six questions about what happened in the story. The finding uncovered that poor readers were less proficient in generating both coherence and elaborative inferences. Cain and Oakhill reconfirmed that readers with poor text comprehension had obstacles with inference making and integration even though they had sufficient word recognition skills. In other words, it is presumable that poor readers are less capable of making inferences because they lack of the text-comprehension ability.

In addition, in Cain et al.'s (2001) research, it was hypothesized that the reason that good readers have a superior inference-making ability is because of greater general knowledge that good readers read more than poor readers for acquiring more information from a text. Cain et al. also reconfirm that the

skilled readers' superior inference-making skills are not simply owing to different loads of their memory for the content of a text and the knowledge base as well. In line with Barry and Lazarte's (1998) study, the purpose of their research focused on examining how domain-related knowledge, syntactic complexity, and reading topic influenced inference-making ability in the written recalls. Fifty-four subjects, 24 high-knowledge and 30 low-knowledge students, participating in this study received the reading packets during the regular class time. All subjects were required to either write everything that they could remember in the text without looking back at the text, or changed the answers after they completed these instructions. The result was indicated that high-knowledge readers produced a richer and more accurate mental model of inference than low-knowledge readers. In a word, good readers outperform poor readers because good readers who possess affluent general knowledge produce abundant and accurate inferences.

Since readers' cognitive reading process related to their language proficiency is still a controversial issue, the purpose of this study is to examine the relationship of English proficiency levels on readers' cognitive operations in terms of identifying main ideas, locating details, and making inferences. Three research questions are addressed for the research purpose: (1) Is there a significant difference among students with different proficiency levels on their usage of cognitive operations in terms of identifying main ideas, locating details, and making inferences? (2) What is the relationship

between students' English proficiency levels and their usage of cognitive operations? (3) What are students' perceptions toward their application of cognitive operations in reading comprehension?

Methodology

Subjects

Subjects in this study were 120 students composed of 22 seniors, 17 juniors, 53 sophomores, and 28 freshmen, majoring in Applied English at I-Shou University participating on a voluntary basis. The subjects encompassed 32 males and 88 females ranging from 19 to 25 years old, with a mean age of 21.5. A demographic questionnaire was provided to collect subjects' background information. Results from the questionnaire revealed that all of the subjects had received formal English instruction for an average of 9 years. To evaluate students' reading proficiency levels, a reading comprehension test composing of three types of test items was conducted on the spring semester of the 2010 academic year in order to categorize those subjects into three groups: low-, intermediate-, and high-English proficiency levels (EPL).

There were 10 items in each type of the reading test including

identifying main ideas, locating details, and making inferences. Subjects would obtain one point if they answered correctly in the multiple-choice test. The test results ranged from 3 to 29 points, with the mean score of 12.5 and the median of 12. Thirty-two subjects (top 27%) whose scores ranged from 16 to 29 were labeled "high," 46 subjects (46%) with the scores of 11 to 15 were labeled "intermediate," and 42 subjects (bottom 27%) with the scores of 3 to 10 were labeled "low." There was a significant difference between the high and low groups, indicating that the high group scored significantly higher ($M = 18.72$, $SD = 3.06$) than the low group ($M = 7.88$, $SD = 2.00$). Thus, the number of subjects in each group was quite appropriate. The detailed information regarding the distribution of subjects is shown in Table 1.

Table 1 Classification of Three Groups

Level	N	Rate	Score	M	SD
High-EPL	32	27%	16 - 29	18.72	3.06
Intermediate-EPL	46	46%	11 - 15	12.39	1.13
Low-EPL	42	27%	3 - 10	7.88	2.00

Note. N=120

Sampling Strategies

To capture an adequate sample size from a larger population pool, both

quantitative and qualitative sampling strategies were employed in the present study. Cluster sampling was first employed to select students ranging from freshmen to seniors, majoring in Applied English at I-Shou University. Subsequently, random sampling was applied to select a sample with 120 students among these four grade levels. Thus, the sample size, 120 students majoring in English at I-Shou University, was chosen to do the questionnaire survey for attaining their self-reports toward the application of cognitive operations. In addition, stratified purposeful sampling was applied in the qualitative interview method because those 15 participants, five from each group, randomly chosen from the 120 students needed to have the experiences of using their cognitive operations in terms of identifying main ideas, locating details, and making inferences while reading. In this research, the number of the 15 participants was decided based upon the adequacy and saturation of their information; in other words, the information collected from those 15 participants, stratified by their three proficiency levels, was sufficient to analyze the research results. Therefore, 15 out of 120 students were selected to explore their in-depth perceptions toward their cognitive operations in the reading process.

Instrumentation

In order to investigate the relationship between English proficiency levels and students' cognitive operations in reading, three types of instruments were used in the study: (1) a reading comprehension test, (2) a questionnaire, and (3) a semi-structured interview technique to canvass deeper perceptions toward the conditions of students' cognitive operations while doing the three types of reading test. More detailed information about the instruments is expatiated as follows.

A Reading Comprehension Test. A reading comprehension test consisting of the items of identifying main ideas, locating details, and making inferences, was extracted from Broukal's (1995) and Phillips's (1996) books pertinent to TOEFL reading comprehension test. "TOEFL" represents Test of English as a Foreign Language, which is an international test to scrutinize non-native English students' English ability (Peirce, 1992). The major reason to select the three types of test items from Broukal's and Phillips's books is that they divided the simulated TOEFL reading test into three sections — main ideas, details, and inferences — which fit in with the aim of the present study. There were 10 items in each type of the reading test and the duration of the test was 50 minutes in total to assure that the subjects had enough time to finish all of the test items. The number of words in each passage was approximately 200 words. A pilot testing was conducted by the first three

participants in order to ensure the content to be comprehensible without the interference of cultural knowledge. From the pilot testers' suggestions, only some vague words were modified for better understanding.

A Questionnaire Design. A questionnaire, a non-experimental research, was designed in the present study to investigate students' self-reports of their cognitive operations while reading. The questionnaire included three sections of the reading cognitive operations in terms of identifying main ideas, locating details, and making inferences. Thirty questions in this questionnaire were composed of 10 questions in the main-idea section, 11 questions in the detailed section, and 9 questions in the inferential section (see Appendix A). What is more, a five-point Likert scale ranging from "5" ("strongly agree") to "1" ("strongly disagree") was administered to examine students' perceptions of cognitive operations. In order to testify validity and reliability of the questionnaire, each questionnaire item was not only adopted from several researchers' studies (Lai, 2006; Shih, 2008), but also examined by using the software, SPSS 17.0, showing that there was a significant difference in each questionnaire item, so all the items should be retained. As to the result of reliability, the Cronbach Internal Consistency Coefficients for the types of main idea, detail, and inference were .79, .76, and .78, respectively.

Semi-structured Interview. Fifteen participants were interviewed individually by using a semi-structured interview technique because it is

essential to gather students' in-depth perceptions toward their usage of cognitive operations while reading. Stratified purposeful sampling was applied in this study. Five participants from each proficiency level were randomly selected for doing the interview. In order to protect the participants from harm, they were informed by a consent form, indicating that they had not only the right to refuse to answer the sensitive questions, but also the volition to withdraw from the interview process any time. Moreover, participants were notified that their personal identities would not be uncovered because their names were replaced with numbers. Each participant was interviewed about 15 to 20 minutes. During the interview process, each participant might answer the questions in either English or Chinese depending on what language the participants could express their own thoughts explicitly. Furthermore, more open-ended answers related to the topic of the present study were encouraged and explored. Sixteen interview questions (see Appendix B) primarily focused on exploring the participants' past, present experiences, and perceptions toward their use of cognitive operations in doing the comprehension test. A pilot testing was done by the first two participants to ensure the validity of the interview questions. Some adjustments were made including the revision of the appropriate tense, the modification of some questions' distortion, and the clarification of the ambiguous questions.

Data Collection Procedure

The pragmatic parallel mixed-method was mainly applied in this study; that is, quantitative and qualitative data were collected simultaneously or with a small time lag. During the process of quantitative data collection, a questionnaire and a reading comprehension test composing of main-idea, detailed, and inferential test items were conducted. In the beginning of the semester, a reading comprehension tests taking 50 minutes was used to investigate students' English proficiency levels and classify them into three groups depending on the outcomes of their reading performance. Subsequently, a questionnaire was conducted immediately after the reading test, in order to explore students' self-reports toward cognitive operation usage in terms of identifying main ideas, locating details, and making inferences while reading.

Finally, after the process of quantitative data collection, individual interview was performed to obtain more in-depth information about the students' perceptions and feedback toward the condition of their cognitive operations. Five students from each group were selected randomly to participate in the interview. Tape recording was used to collect participants' perceptions; moreover, participants' answers were transcribed by the researcher.

Data Analysis

In this study, both quantitative and qualitative research techniques were utilized to explore the following three research questions: (1) Is there a significant difference among students with different proficiency levels on their usage of cognitive operations in terms of identifying main ideas, locating details, and making inferences? (2) What is the relationship between students' English proficiency levels and their usage of cognitive operations? (3) What are students' perceptions toward their application of cognitive operations in reading comprehension?

In order to scrutinize the difference of students' English proficiency levels on their usage of cognitive reading operation, a one-way analysis of variance (ANOVA), which the independent variable is the students' English proficiency levels and the dependent variable is their self-reports of the three cognitive operations, was implemented to investigate whether students with different English proficiency levels had significant differences on their usage of cognitive operations.

Additionally, a bivariate (zero-order) correlation analysis was employed to investigate the relationship between the variables of English proficiency levels and students' self-reports of their usage of cognitive operations. More specifically, a correlation coefficient (r) was calculated to examine whether

these two variables were significantly correlated. Another consideration with respect to the significance of correlations is the magnitude (strength) and direction of the correlations. The number that represents the correlation can range from -1.00 to +1.00. A high positive value represents a high positive relationship, a low positive value represents a low positive relationship, and so on (McMillan & Schumacher, 2006).

Finally, a semi-structured interview technique was applied to explore more in-depth information about students' perceptions toward their usage of cognitive operations. Tape recording was employed during the interview process. After the interview, all of the participants' expressions were transcribed by the interviewer in order to analyze participants' perceptions regarding their cognitive operations while doing the reading comprehension test. After transcribing, the interesting units were marked and labelled for further content analysis.

Results

Research question 1: Is there a significant difference among students with different proficiency levels on their usage of cognitive operations in terms of identifying main ideas, locating details, and making inferences?
One way analysis of variance (ANOVA) was conducted to analyze whether

there is a significant difference among high-, intermediate-, and low-level students' self-reports toward their usage of cognitive operations. As indicated in Table 2, there are two significant differences at the .05 probability level between groups: identifying main ideas [F (2, 117) = 6.283, p = .003] and locating details [F (2, 117) = 3.488, p = .034], indicating that there are two statistically significant differences among three proficiency levels on the variables of identifying main ideas and locating details.

Table 2 One-way ANOVA Analysis between Students' Proficiency Levels and
Cognitive Operations

	SS	df	MS	F	Sig.
Identifying Main Ideas					
Between Group	389.11	2	194.56	6.28	.003*
Within Group	3622.757	117	30.96		
Total	4011.867	119			
Locating Details					
Between Group	197.32	2	98.67	3.49	.034*
Within Group	3309.660	117	28.29		
Total	3506.992	119			
Making Inferences					
Between Group	38.31	2	19.15	.85	.431
Within Group	2642.019	117	22.58		
Total	2680.325	119			

Note. * p < .05

A post hoc comparison procedure was further employed to examine each
possible pair of means for significant differences. The result in Table 3
indicates that high-level students scored significantly higher than low-level
students (Mean Difference = 4.58) in the section of identifying main ideas. As
for locating details, the result reveals that high-level students scored significantly
higher than intermediate-level students (Mean Difference = 3.08). However, in the

section of making inferences, there is no significance difference among proficiency levels, indicating that students with either better or poorer reading ability did not realize their usage of cognitive operations while reading.

Table 3   A Post Hoc Comparison among Proficiency Levels on Cognitive Operations

Levels		Mean Differences	Sig.	Scheffé	Multiple Comparison
		Identifying Main Ideas			
H	I	3.13	.054		
	L	4.58	.003*	H>L	
I	H	-3.13	.054		H>L
	L	1.45	.478		
L	H	-4.58	.003*	L<H	
	I	-1.45	.478		
		Locating Details			
H	I	3.08	.046*	H>I	
	L	2.63	.113		H>I
I	H	-3.08	.046*	I<H	
	L	-.45	.923		
L	H	-2.63	.113		
	I	.45	.923		
		Making Inferences			
H	I	.91	.707		
	L	1.45	.433		
I	H	-.91	.707		
	L	.54	.870		
L	H	-1.45	.433		

p < .05, H=High-EPL , I=Intermediate-EPL, L=Low-EPL

Research question 2: What is the relationship between students'
English proficiency levels and their usage of cognitive operations?

A Pearson Product-Moment Correlation Coefficient analysis was conducted
to investigate the relationship between students' English proficiency levels
and their cognitive operations in terms of identifying main ideas, locating
details, and making inferences while reading. The result shows that there are
significantly positive relationships at the .05 probability level between
students' reading scores and identifying main ideas (r = .335) as well as
locating details (r = .191). The results show that students with higher reading
scores have better reading performance in identifying main ideas and locating
details; in other words, students with lower reading scores have worse
reading performance in identifying main ideas and locating details, since
there is a positive relationship between the variables. However, there is no
significant relationship between students' reading comprehension scores and
their self-report to the inference-making ability. Such a result is consistent
with the previous finding: Students with either better or poorer reading ability
are not aware of their usage of making inferences while reading.

Research question 3: What are students' perceptions toward their
application of cognitive operations in reading comprehension?

Utilizing reading strategy to identify main ideas. To further elicit the
participants' in-depth perceptions toward the conditions of cognitive

operations in reading comprehension, five participants were randomly selected from each proficiency level to do individual interview. The interview results show that students could utilize reading strategy to identify main ideas during the reading process. Based on the comments of participants #1 and #12, their perceptions are presented in the following.

When I identified main ideas, I could skim the paragraph to look for some important sentences and information. Also, I read the first and last sentences which are the topic and concluding sentences, and I further tried to summarize the points of view for identifying the main theme. (participant #1)

Amid the process of identifying main ideas, I would read the questions at first, and then I skimmed the whole paragraph to discover important information. Moreover, I read the first and last sentences for better comprehension because the main idea of a text usually can be captured within these two sentences. (participant #12)

The importance of prior knowledge. In addition, several participants claimed that it is important to possess prior knowledge relevant to a text because it facilitates them to capture the main ideas correctly and efficiently. For instance, participants #2 and #13 conveyed that, I think that prior knowledge is important to me. For example, if I am familiar with the content of a text, I could easily capture the main ideas even though there are lots of terminologies that I have not learned before. (participant #2) It is important to possess certain prior knowledge because I would not only understand the

content effectively based on my background knowledge, but also more realize the terminology related to the topic. (participant #13)

The difficulties of identifying main ideas. What is more, some participants declared that the difficulty in identifying main ideas depends upon whether they are able to comprehend long and complicated sentence structures with the interference of unknown vocabulary. According to the opinions of participants #1 and #15, they illuminated that, I considered that it depends on how much vocabulary I have known. For instance, if the vocabulary is too difficult, I could not understand the content, so as not to capture the main idea. (participant #1) It is hard to identify main ideas because it is necessary to comprehend a text and summarize the major points to comprise them into an overall picture. (participant #15)

Utilizing reading strategy to locate details. On the other hand, the research results show that students would utilize reading strategies to facilitate them in locating details in the reading comprehension process. Based on the results, participants #5 and #6 exemplified that, I would read the questions first to see the keywords, and then look for the keywords of a text and underline them to locate specific details. (participant #5) I not only pay attention to the keywords, but also notice 5W1H consisting of who, where, what, when, why, and how, to locate the specific details. (participant #6)

The difficulty of locating details. From the majority's perceptions, participants argued that it might be either easy or difficult to locate details because the difficulty of locating details depends on whether there is much unknown vocabulary interfering students' reading comprehension. Based on the perspectives of participants #3 and #9, they ascertained that, it is easy to locate details because I can find out some keywords and clues to locate details which are indicated in a text explicitly. (participant #3) I think that it might be either hard or easy to locate details. First of all, it might be hard when I can not recognize the vocabulary and understand each sentence to locate details. However, it might be easy because I can utilize reading skills such as realizing the structure of a text to locate details. (participant #9)

Difficulties in making inferences. Several participants affirmed that it is difficult for them to make inferences even though they try to use reading strategies to comprehend a text in their reading process. According to the opinions of participants #9 and #11, they proposed that, I tried to understand the text completely by three steps including reading the topic sentences, supporting ideas, and concluding sentences; however, it is hard for me to draw inferences because I lack of vocabulary knowledge to understand the content and also be short of prior knowledge to integrate the information. (participant #9) I attempted to understand each word and the connotation of each sentence behind a text, but it is hard to make inferences because I did not have abundant background knowledge, so as not to understand a text

completely. (participant #11)

Discussions

The purpose of this study aims to investigate the difference and relationship between students' English proficiency levels and their cognitive operations in terms of identifying main ideas, locating details, and making inferences, and further to explore students' in-depth perceptions toward their cognitive operations in the reading process.

First of all, regarding the difference among different English proficiency levels and students' three cognitive operations, the finding of the present study demonstrates that students with the high proficiency level scored significantly higher than those with the low proficiency level. Such a result matches the previous studies (Chen, 2006; Commander & Stanwyck, 1997; Palincsar & Brown, 1984; Stevens, 1986; Winograd, 1984), indicating that good readers not only are more aware of important information of a text, but also possess better summarizing ability and affluent prior knowledge for acquiring main ideas and overall gist than poor readers; in other words, poor readers encounter difficulties in utilizing reading strategies to identify main ideas of a text in the reading process. In addition, there is a significant difference between different English proficiency levels and students'

cognitive operations in terms of locating details, illustrating that students with the higher proficiency level scored significantly higher than those with the lower proficiency level. Such a result supports findings in the literature (Cheng & Good, 2009; Tal et al., 1994), suggesting that poorer readers lacking of retention and word recognition are unable to locate specific information of a text. Regarding the result of making inferences, it is shown that students' inference-making ability is not significantly related to their reading proficiency levels. Part of the reason is that the majority of students affirm that it is difficult for them to make adequate inferences because they lack not only affluent prior knowledge related to a text but also word recognition, so as not to comprehend a text at large. Such a result does not confirm the previous studies (Cain & Oakhill, 1999; Cain et al., 2001; Cain et al., 2004; Hammodou, 1991; Tal et al., 1994), interpreting that good readers with abundant general knowledge and the ability of inferential processing should make appropriate and correct inferences than poor readers.

Secondly, concerning the relationship between students' English proficiency levels and their cognitive operations, the findings of the present study indicate that there are significant relationships among students' reading scores and their reading performance in terms of identifying main ideas and locating details. Such results coincide with previous studies (Cain & Oakhill, 1999; Cain et al., 2001; Cain et al., 2004; Cheng & Good, 2009; Hammodou, 1991; Tal et al., 1994), indicating that students with better reading

comprehension have better reading performance in identifying main ideas and locating details; in other words, students with worse reading scores have worse reading performance as well. On the other hand, there is no significant relationship between students' reading scores and their inference-making ability. Such a result does not confirm the previous studies (Cain & Oakhill, 1999; Cain et al., 2001; Cain et al., 2004; Hammodou, 1991; Tal et al., 1994), showing that students with higher reading scores should have better performance in making inferences. Part of the reason is that the majority of EFL students regard themselves as readers with the deficiency of background knowledge and lack of vocabulary for making correct inferences. It is obvious to find out that the result of a correlation analysis is apparently consistent with the result of ANOVA, manifesting that students with higher reading comprehension utilize effective reading strategies use in identifying main ideas and locating details; however, there is no significant difference and relationship between students' reading scores and their inference-making ability.

To further explore students' perceptions toward the conditions of their cognitive operations in reading, the majority of students stated that they often use reading strategies such as reading the topic and concluding sentences as well as skimming the whole paragraph in order to discover the important information of a text (Meneghetti, Carretti, & De Beni, 2006; Stevens, 1986).

Also, students considered that prior knowledge is of great importance in identifying main ideas because students are familiar with the content so as to capture the main ideas easily; such a result corresponds to the previous studies (Chen, 2006; Haenggi & Perfetti, 1992; Pang, 2008), showing that students can successfully identify main ideas of a text is because they are capable of utilizing summarizing ability to integrate their prior knowledge for overall comprehension.

In addition, regarding the cognitive operation of locating details while reading, most students signified that they frequently employ reading strategies such as scanning the whole text to locate some keywords and clues for discovering specific information of a text (Meneghetti, Carretti, & De Beni, 2006). Additionally, students expressed that both retention ability and vocabulary knowledge are of great importance in locating details because they can locate details by remembering the specific information of a text without the interruption of unknown vocabulary in the reading process; such a result supports the previous studies (Cheng & Good, 2009; Tal et al., 1994), discerning that students are able to locate details because they possess affluent retention ability to remember the specific information of a text, but they might be unable to locate details correctly if there is too much difficult vocabulary.

With regard to students' cognitive operation of making inferences, several students alleged that they attempt to comprehend the whole text for

complete understanding of a text; that is, they try to utilize inference-making

strategies to draw appropriate inferences in accordance with the content of a

text (Hammadou, 1991). Students generally agree that background

knowledge is so important for drawing inferences in addition to

text-comprehension abilities; such a result matches the previous researches

(Barry & Lazarte, 1998; Cain & Oakhill, 1999; Cain et al., 2001; Tal et al.,

1994), suggesting that high-level students with affluent background

knowledge should produce accurate and abundance inferences based on their

good text-comprehension ability. However, from the research result of the

inferential processing, it is apparent to find out that students generally are not

aware whether they use the accurate inference-making strategy or not. Part of

the reason is that the majority of students are not capable of their inferential

processing due to the fact that EFL readers often lack of vocabulary

knowledge (Cheng & Good, 2009) and also be short of background and prior

knowledge relevant to a text (Barry & Lazarte, 1998), so as to fail to integrate

and remember the information while making inferences (Cain et al., 2001).

Conclusion

    To sum up, although investigations of EFL reading comprehension in

cognitive reading process have identified the different performances by good

and poor readers (Barry & Larzarte, 1998; Carrel, 1992; Commander & Stanwyck, 1997; Hammadou, 1991; van den Broek et al., 1993), yet until recently there have been fewer studies focusing on EFL learners' reading performance in a Taiwanese learning context. Therefore, it is essential to realize the relationship between EFL students' different English proficiency levels and their cognitive operations in a Taiwanese environment. Concerning with the research findings of the present study, high-level students make better use of their prior knowledge and integrate reading strategies to identify main ideas than low-level students; moreover, high-level students with good retention ability can utilize appropriate reading strategies to locate details. Therefore, it is proved that EFL proficiency could intercept readers' perceived use of strategy and cognitive operations (Barry & Larzarte, 1998; Cain et al., 2001; Cain et al., 2004; Carrel, 1992; Commander & Stanwyck, 1997; Hammadou, 1991; Meneghetti, Carretti, & De Beni, 2006; Pang, 2008; van den Broek et al., 1993). It is expected that the research results of the present study can provide EFL instructors with a strategic application and pedagogical implication in the reading class to guide students to use appropriate reading strategies use in their reading process.

Limitations of the Study

Although there are significantly positive relationships between students'

reading scores and their self-report toward the cognitive operations in the reading process, four limitations need to be ameliorated and improved in the future study. First of all, regarding the samples from the population pool, the subjects, consisting of only 120 students, were too small. As a result, it is hard to reach generalization due to such a small sample size. Secondly, all the subjects were only English-major students. Therefore, the research results may not be applied to non-English major students. Thirdly, the time for doing a reading comprehension test might be too short, so that students could not finish all the test items in the limited time. Finally, some issues consisting of gender, individual differences, and motivation to participate in this study were not taken into considerations. Therefore, it is essential to realize that those factors might influence the research results.

In the future research, it is suggested to enlarge the sample size with the other non-English major students. Moreover, a reasonable amount of time for doing the reading test should be taken into considerations. Furthermore, the other consideration of individual differences such as attitudes, gender, and how such variables may influence the use of cognitive operations should lead to future research design.

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Appendixes

Appendix A: Questionnaire

    1. Name: _____   2. Gender (M / F): _____

    3. Student No.:_____   4. Dep. & grade: _____

    5. I've learned English for _____ years.

     Please tick inside the box next to the statement that best describes your tendency of cognitive operations while reading.

(5=Strongly Agree; 4=Agree; 3=No Comment; 2=Disagree; 1=Strongly Disagree)

I. Identifying main ideas

	5	4	3	2	1
1. I lack of prior knowledge about the text to identify main idea.	☐	☐	☐	☐	☐
2. I can utilize the topic sentences to identify the gist.	☐	☐	☐	☐	☐
3. I can skim whole paragraph to extract vital information.	☐	☐	☐	☐	☐
4. I can summarize the main points of a text.	☐	☐	☐	☐	☐
5. I can discriminate main ideas from supporting details.	☐	☐	☐	☐	☐
6. If I am familiar with the content, it's easy to identify main idea.	☐	☐	☐	☐	☐
7. I can't summarize the whole text.	☐	☐	☐	☐	☐
8. I can't discriminate main ideas from supporting details.	☐	☐	☐	☐	☐
9. I don't skim the text to extract the main idea.	☐	☐	☐	☐	☐
10. I don't know enough vocabulary to know main idea.	☐	☐	☐	☐	☐

II. Locating details

	5	4	3	2	1
1. I lack of retention, so I always forget details.	□	□	□	□	□
2. I can scan the paragraph to find out the details.	□	□	□	□	□
3. I can't locate specific details because many unknown vocabulary interfere my reading.	□	□	□	□	□
4. When the text is short, I can't locate details correctly.	□	□	□	□	□
5. I read the text repeatedly to find out details instead of scanning the text.	□	□	□	□	□
6. I can locate specific details because I understand enough vocabulary.	□	□	□	□	□
7. I can pay attention to details when reading a text.	□	□	□	□	□
8. I look for some clues for locating details.	□	□	□	□	□
9. I can't concentrate on a text while locating details.	□	□	□	□	□
10. When the text is long, it's easy to locate details.	□	□	□	□	□
11. I remember the context while locating details.	□	□	□	□	□

III. Making inferences

	5	4	3	2	1
1. I can predict the following paragraph while reading.	□	□	□	□	□
2. I can guess the author's purpose of this text..	□	□	□	□	□
3. I can analyze complex structures to make inferences.	□	□	□	□	□
4. I can infer the content which might describe before.	□	□	□	□	□
5. I can't guess the content of following paragraph.	□	□	□	□	□
6. It's hard to infer because of complex structure.	□	□	□	□	□
7. I can't predict the content which might happen before.	□	□	□	□	□
8. I don't understand the author's purpose while reading.	□	□	□	□	□
9. I can make inferences according to the context.	□	□	□	□	□

Appendix B: Semi-structured Interview Questions

I.   Identifying Main Ideas

1. What is your first time to test the ability of identifying main ideas?
2. Could you illuminate what techniques you normally use while identifying main ideas?
3. Do you think that prior knowledge plays an important role on identify main ideas? Why or why not?
4. Do you think it is difficult to identify main ideas? Why or why not?
5. How you think about your ability of identifying main ideas? Good or bad? Why?

II. Locating Details

6. What is your first time to test the ability of locating details?
7. Could you illuminate what techniques you normally use while locating details?
8. Do you think that retention is important while locating details? Why or why not?
9. Do you think it is difficult to locate details? Why or why not?
10. How do you think about your ability of locating details? Good or bad? Why?

III. Making Inferences

11. What is your first time to test the ability of making inferences?
12. Do you think your ability of making inferences is affected by reading comprehension? Why or why not?
13. Could you illuminate what techniques you normally use while making inferences?
14. Do you think it is difficult to make inference? Why or why not?
15. How do you think about your inference-making ability? Good or bad? Why?
16. Do you think that there is any relationship between reading comprehension and each type of questions?