A STUDY OF THE EFFECTS OF TWO READING ENVIRONMENTS ON L2 READERS’ STRATEGIC BEHAVIORS TOWARD UNKNOWN WORDS

DISSERTATION

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ABSTRACT

This study explored effects of reading environments (computer-based and print-based texts) on L2 learners’ strategic behaviors in coping with unknown words while reading texts in English. Their perceptions of or attitudes toward their strategic behaviors (ignoring, inferencing, dictionary consultation, or etc.) in the two reading environments were also investigated. This study employed a mixed methods approach (quantitative and the qualitative) for data gathering. The participants in this study were 34 international students at the Midwest university.

The results showed that reading environment did appear to affect learners’ strategies for coping with unknown words, but the effect was not substantial. The learners employed more strategies in computer-based texts (CBT) than in print-based texts (PBT). In terms of the learners’ levels of vocabulary knowledge, the advanced group was influenced by the effect of reading environment more than the other two groups (intermediate and low). Although the effect of reading environment was almost negligible in the low group, the frequency of strategies employed by this group was far greater than the other two groups.

With regard to the participants’ academic level, there was more influence of reading environment in graduate students than undergraduate students. Graduate students employed strategies more frequently than undergraduate students across both
environments. They also employed more strategies in CBT than in PBT. Interestingly, undergraduate students employed slightly more strategies in PBT than in CBT.

Likewise, although the difference was not substantial, reading environment did affect strategy use relative to L2 learners’ country of origin (Mainland Chinese, Koreans, and Taiwanese). Both Mainland Chinese and Taiwanese students employed more strategies in CBT than PBT. However, Korean students employed more strategies in PBT than CBT. Taiwanese students employed strategies more frequently both in CBT and PBT compared to the other groups.

The findings also revealed that regardless of the L2 learners’ level of vocabulary knowledge, academic level, and country of origin, dictionary consultation was predominantly employed followed by inferencing in dealing with unknown words across environments. However, there is some variance among and within the three categories in terms of the frequency of the use of these two strategies according to environment.

The interview data revealed that all the participants showed a strong preference for PBT over CBT when reading for academic purposes, rather than reading for pleasure, such as newspapers or magazines. However, there were contrary responses in terms of the participants’ perception of effects of reading environment. That is, some participants reported that their strategic behaviors were not influenced by reading environment, while others reported the opposite view.

Lastly, there was no great variance in relation to reasons for employing each strategy (ignoring, inferencing, dictionary consultation, or etc.) according to the participants’ level of lexical knowledge, student status, and country of origin. It was also
found that many participants preferred a bilingual dictionary over a monolingual dictionary. However, some participants used either a monolingual dictionary or a combination bilingual/monolingual dictionary as well. Besides that, most participants used either an online dictionary or an electronic dictionary depending on its availability.
Dedicated to my beloved family who made this work attainable
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CHAPTER 1

INTRODUCTION

1.1 Background

Reading is one of the most complex, crucial, and foundational skills in learning (Cheng, 1996; Koda, 2007), but it can vary widely among learners. Learning to read is a cognitively demanding and elaborate process for learners, involving coordination of attention, memory, comprehension processes, strategies, and lexical knowledge (Anderson, 1991; Ryan, 1997; Yap, 1978). In an academic setting, to find main ideas, essential information, general information, or specifically required information, learners are required to read texts selectively and intensively (Birch, 2002; Cheng, 1996). They also need to adjust the relative speed of their reading to the task that they need to perform. To extend their knowledge independently of their teachers, learners, especially those at the college level, need to be equipped with a high level of reading proficiency as they encounter large amounts of academic material (Arden-Close, 1993; Bang & Zhao, 2007). Thus, due to the importance of and the need for good reading proficiency in accessing academic material, competence in reading is an essential component in overall academic success (Kuhn & Stahl, 1998). This is especially true for L2 learners.
Within the past few years, in association with these insights into the significance of reading, rapid growth and development of technology has led to a noticeable breakthrough in understanding the role of language learning environments, particularly in the field of reading. Technology, which enhances language learning and teaching, can transform and modify the reading environment in which it operates, creating a “dynamic online environment within which literacy skills are increasingly applied” (McEneaney, 2006, p. 368). For this reason, widespread views of literacy that are grounded on paper-based material need to be revised for reading in computer-based and multimedia worlds. Technology has the potential to positively facilitate reading comprehension and vocabulary learning. With the advent of new learning environments, several researchers speculate that language learners’ reading performance and their strategies for and patterns of vocabulary learning might depend on the learners’ learning environment, whether computer-based or paper-based (Al-Jarf, 2007; Lim & Shen, 2006; Tozcu & Coady, 2004; Tseng, 2008). Schmitt and McCarthy (1997) also pointed out that language-learning strategies vary depending on the contexts in which they are used, their combination with other strategies, and the learners’ proficiency levels.

In terms of environment, the most significant difference between the computer-based reading environment and the paper-based reading environment is the way in which the learners engage with the text through different reading behaviors, including the use of different strategies to understand the reading materials and the unknown words (McDonell, 2006). While the paper-based reading environment puts readers in the role of autonomous agents and the text in the role of a non-autonomous supporting agent, the
computer-based reading environment is believed to be more dynamic (McDonell, 2006; McEneaney, 2006). Although readers in the paper-based environment can decide which page to read or which unknown words or ideas to look up, the computer-based reading environment goes beyond what is possible in the paper-based reading environment. On a computer, the text can respond to readers and readers can define text structure depending on reader-selected links (McEneaney, 2006). Readers can skip from one part of a text to another based on their own interests without being limited by the author’s predetermined order of thoughts. Also, the reader can focus on specific words or phrases even within a single text by directing his or her questions or comprehension while reading (Alicia, 2001; Chun, 2001; Cooledge, 2004; Hunter, 1998; Logie, 2001).

In the meantime, as stated earlier, L2 learners’ ability to easily read and understand written texts is central to success in their studies, and their vocabulary knowledge has been shown to be the most indispensable component of reading proficiency (Bialystok, 1983; Chikalanga, 1993; Coady & Huckin, 1997; Grabe & Stroller, 1997; Laufer, 1997). That is, to them, “by far the greatest lexical obstacle to good reading is insufficient number of words in the learner’s lexicon” (Laufer, 1997, p. 31). In particular, when they try to interpret an authentic text, insufficient vocabulary knowledge is likely to hinder overall reading comprehension. In addition, many researchers have repeatedly shown a strong correlation between reading ability and vocabulary knowledge (Anderson & Freebody, 1983; Koda, 1989, 1997; Laufer, 1989, 1992).
In spite of this strong relationship between L2 learners’ reading performance and their vocabulary knowledge, unlike the topic of L2 learners’ overall development of reading skills, which has long been a concern of researchers and teachers, there was a relative neglect of lexical research into vocabulary acquisition until 1980 (Huang, 2006). This neglect is all the more striking given that L2 learners themselves have long been well aware that they experience considerable difficulty with vocabulary (Meara, 1980). In recent years, due to a growing recognition of the critical importance of learners’ vocabulary knowledge in reading comprehension, there has been increased interest among researchers and scholars in the field of second language acquisition in how L2 learners, particularly in an academic setting, cope with the heavy demands of acquiring (unknown) words (Nassaji, 2004, 2003; Parry, 1991; Roskams, 1998).

1.2 Statement of the Problem

Perhaps the most serious challenge facing any second-language (L2) learner is that of vocabulary acquisition—acquiring in a short time sufficient knowledge about the many thousands of different words that will be encountered in written texts, for example. Ordóñez, Carlo, Snow, & McLaughlin, 2002, p. 719).

A substantial body of literature both in L1 and L2 reading has persistently reported a significant relationship between learners’ vocabulary knowledge and reading performance (Nagy & Anderson, 1984; Grabe & Stoller, 1997; Koda, 1997; Laufer, 1992; Yap, 1979). For example, Grabe and Stoller (1997) claim that “reading improves vocabulary knowledge and vocabulary knowledge supports reading development” (p. 119). Furthermore, knowledge of basic and frequently used words in English is believed
to be essential to learning to read and, despite the critical importance of L2 learners’ vocabulary knowledge, this lack is the single largest obstacle to reading as well and to academic success. For decades it was generally believed that L2 learners did not need more than 2000 or 3000 words, resulting in critical ignorance about the process of learning and teaching vocabulary (Kelly, 1990).

Coupled with the importance of vocabulary in reading, exposure to unfamiliar words is a natural part of encountering new subjects in an academic context. Thus, learners are forced to develop ways of compensating for lack of knowledge and unknown words (Roskams, 1998; Swain, 1997). They must also develop independent strategies for dealing with the new words they encounter on a daily basis in other contexts. Accordingly, as a way of understanding the ways in which learners cope with new words, researchers have identified several strategies that learners use to deal with unknown words, such as ignoring them (knowing when to skip or pass a word), looking them up in a dictionary, asking someone who knows their meanings, or guessing from context (Laufer, 1997).

However, despite the significance of understanding learners’ strategies for dealing with unknown words, studies on learners’ strategy use are one of the most limited and inconclusive areas in the overall research on learning and teaching vocabulary (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006). While there has been much research into how L2 learners deal with unknown words, most of the research has exclusively been related to reading paper-based texts (Parry, 1991; Nassaji, 2004; 2003; Qian, 2004). In addition, although there is abundant research involving the use of computer technology
in language learning and vocabulary, most of the research has been devoted to studying the relationship of annotations or glosses to reading comprehension, retention of vocabulary, or learners’ preferred modes of annotation (Abraham, 2007; Ariew & Ercetin, 2004; Busch, 2003; Chun, 2001; Liu, 1995; Lomicka, 1998; Sakar & Ercetin, 2004).

In the meantime, there has been a tangible movement towards researching and understanding the role of context in learning, in particular, the growing involvement of technology, such as the Internet, hypertext, or multimedia in language teaching and learning due to the rapid development of technology. Coupled with the increasing availability of the Internet and the rapid infiltration of new technologies in learning, reading on the computer (for example, on the Internet or web) has become widespread (Jacobs, 1994; Logie, 2001). Students have online access to a considerable amount of reading material, such as newspapers, magazines, or journals, which brings new forms of reading texts and reading experiences to learners by creating new reading environments (McDonell, 2006).

As mentioned earlier, scholars acknowledge that reading computer-based texts is not the same as reading paper-based texts (Cooledge, 2004; McDonell, 2006), and that learners’ strategic behavior may vary depending on learning environment (Schmitt & McCarthy, 1997). As an extension of these assertions, it is possible that L2 learners’ approach to unknown words while reading computer-based texts might differ from their approach to paper-based texts. Thus, considering the growing involvement of technology and the significance of vocabulary in reading and learning, how L2 learners actually deal with unknown words both in computer-based texts and in paper-based texts appears to be
an important topic for investigation because of the widespread access of learners to both kinds of texts (Al-Seghayer, 2001).

However, until now little research has been carried out on L2 learners’ strategic behaviors for coping with unknown words both in computer-based texts and print-based texts. Because of the importance of vocabulary and the increasing incorporation of technology in learning and reading, it is necessary to investigate and understand how L2 learners deal with unknown words in these two different reading environments.

### 1.3 Research Questions

With these thoughts above in mind, this study attempts to fill a gap in research about L2 learners’ strategic behaviors toward unknown words in two different reading environments. To do so, the present study addresses one overarching question: “Does reading environment (computer-based and print-based) have any effects on L2 readers’ strategic behaviors with respect to unknown vocabulary?” In order to explore the overarching question, the present study was guided by the following more focused research questions:

1. What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ level of lexical knowledge (advanced, intermediate, and low) in their strategic behavior toward unknown word meanings?

2. What are the differences/similarities of the effects of reading environment, computer-based and print-based, between L2 undergraduate students and graduate students in their strategic behavior toward unknown word meanings?
3. What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ country of origin in their strategic behavior toward unknown word meanings?

4. What are the L2 learners’ perceptions of their employing strategic behaviors (ignoring, inferencing, dictionary consultation, etc.) in dealing with unknown words in association with two different reading environments?

As the research questions suggest, this study dealt with second language reading, but it is important to point out that its focus was not on such domains of reading as comprehension or reading processes, domains in which reading strategies and strategic behavior are examined. This study focused more specifically on the vocabulary side of reading.

1.4 Significance of the Study

Today’s learners and readers have unprecedented access to authentic texts through the Internet or multimedia tools, due to the development of technology. With the increased use of technology in language learning, learners also have more opportunities to read computer-based texts as well as traditional print-based texts. Regardless of the type of reading environment, it is inevitable that L2 learners encounter many unknown words while reading. In certain contexts, just one word that the reader does not know can cause a sentence or even a whole passage to be incomprehensible (Davis, 1989). Thus, considering the important role of L2 learners’ vocabulary knowledge both for reading performance and academic success, investigation into how L2 learners deal with unfamiliar words both in computer-based texts and print-based texts has become
increasingly important. In an effort to help L2 learners comprehend texts and become successful in their academic areas, this study’s potential to answer the above research questions can be significant in several ways.

First, research comparing L2 learners’ strategic behaviors for coping with unknown words in computer-based and print-based texts is scarce in the professional literature. Given the accessibility of technology in language learning and the fact that most studies concerning unknown words have been devoted to print-based texts, this study can provide insight into how learners in different environments approach unknown words while reading English texts. As a result, not only teachers but also L2 learners will be able to develop an understanding of the need for and the importance of specific strategy use in comprehending unknown words across different environments.

In addition to focusing on L2 learners’ strategic behavior in print-based texts, most previous research that has devoted even cursory attention to computer-based texts has explored only a single specific type of strategy use in dealing with unknown words, such as dictionary looking up behavior. Little research has been conducted on L2 learners’ strategic behavior that includes multiple specific types of strategies for encountering unknown words. In order to consider the comparative value of different behaviors, this study includes several strategic behaviors and does not emphasize one specific strategy. Furthermore, the strategies explored in this study are not manipulated or categorized by a researcher; rather, they are identified by the L2 learners themselves. As a result, this research can illuminate L2 learners’ multifaceted strategic behaviors toward computer-based texts in a natural setting. Through this approach, educators can receive holistic
pictures of L2 learners’ behaviors, especially in the computer-based environment. Also, educators will be able to obtain new knowledge of how a computerized learning environment can foster L2 learners’ behavior toward unknown words more effectively.

Third, this study can reveal learners’ perceptions of the importance of unknown words to understanding sentences or passages both in computer-based and print-based texts. More importantly, through the findings of this study, learners can become aware of the best strategy for each particular reading environment, since “strategies are dependent on the context in which they are used” (Schmitt, 1997, p. 202). It is important for learners to reflect on their own learning processes and to understand which approaches provide the best ways to comprehend unknown words, and which approaches are most effective for different reading environments (Wenden, 1999). As a result of this knowledge, learners can enhance their overall reading performance and vocabulary acquisition.

Fourth, the results of this study have significant pedagogical implications not only for L2 learners, who are pursuing higher degrees in an English environment and who need to develop strategies for academic success, but also for teachers attempting to develop curricula for their students. Without a complete understanding of how L2 learners process unknown words while reading, L2 educators cannot make correct instructional decisions to help their students develop strategies to confront unknown words. This is an essential factor for comprehending texts, for developing vocabulary knowledge, and for developing language proficiency in the long run. By understanding how learners select the best strategy and use the strategy successfully in different reading environments (Anderson, 1995), teachers can recognize what their learners need, what their learners
can learn, and what they can do to enhance their learners’ language proficiency. In addition, teachers can help the learners develop appropriate strategic behaviors by considering several factors, such as learners’ proficiency level, texts, language modality, or learner characteristics that come into play with learners’ use of different strategies (Schmitt, 1997).

Also, by bringing together quantitative with qualitative data, this study demonstrates that L2 learners’ vocabulary knowledge, as well as their approach to unknown words, can be seen along continuums (Palmberg, 1987), with great variation among individuals. Given that we need to be cautious about the extent to which we can rely on research results purely generated from survey data, which can either ignore or overlook some of the critical characteristics of L2 learners’ approaches (Qian, 2004), this study can offer particularly deep insights into individual learners’ behaviors toward unknown words. Through in-depth descriptions and interviews, this study more fully reflects learners’ actual approach to comprehending word meanings than previous work. Stated another way, investigating learners’ behaviors through a questionnaire cannot fully reflect the learners’ actual approaches to unknown words – the complex process of what goes on in the learners’ minds and how the learners arrive at their comprehension of the words. Thus, with the help of detailed, intensive, and thick explanations of their approaches, which are extracted from the learners themselves, a more precise and finer process will be uncovered. By including not only a quantitative component but also qualitative learner-centered descriptions and delayed retrospective think-aloud processes,
this study compensates for the two different methods’ weaknesses and maximizes their strengths, making the findings more reliable and valuable.

Lastly, by investigating L2 learners’ approaches to unknown words in different reading environments, this study establishes a specific, reliable, and valuable foundation for further information and research. As stated earlier, considering that most research on coping with unknown words has been carried out exclusively on print-based texts, this study can produce another important foundation for computer-based texts by discovering new patterns through comparing the two environments. More importantly, this study can foster other research with respect to L2 learners’ behavior toward unknown words by expanding this line of research on L2 learners’ approaches to unknown words.

1.5 Definition of Key Terms

- **L2 Learners**: learners who have learned English as foreign/second language (EFL/ESL) after acquisition of their first language; in particular, for this study, L2 learners refer to those who finished their high school education in their home countries and have been in the US pursuing their degree (B.A., M.A., or Ph. D.) as ESL learners.

- **Print-based text**: a type of any text displayed on paper, such as a traditional hard copy; in this study, print-based texts and paper-based texts are used interchangeably.

- **Computer-based text**: a type of text displayed on a computer screen; also, in this study, it refers to the text displayed either in an online (through the Internet) or offline format, such as html or PDF, on a computer screen.
Strategic behavior: techniques, as conscious cognitive or metacognitive activities, that learners apply of their own free will to enhance the effectiveness of their learning and used by learners to assist in the acquisition, storage, and retrieval of information upon encountering unknown words (Nassaji, 2003). For this study, strategic behaviors are operationalized as ignoring, inferencing, and dictionary consultation, both in a computer-based text and a paper-based text.

- Ignoring: a strategy in which learners do not pay attention to unknown words.
- Inferencing: a process of “making informed guesses as to the meaning of a word in light of all available linguistic cues in combination with the learner’s general knowledge of the world, her awareness of the context and her relevant linguistic knowledge” (Haastrup, 1991, p. 40).
- Dictionary Consultation: a process of finding out the meanings of unknown words by consulting a dictionary; in this study, it refers to looking in an online, electronic or traditional paper dictionary to figure out meanings of unknown words.
- Multiple Strategy Use: a process of employing more than one strategy; in this study, it refers to employing a combination of two of the strategies, ignoring, inferencing, or dictionary consultation

1.6 Assumptions of the Study

For this study, the following assumptions were made:

1. The participants would participate in this study voluntarily.
2. The participants would be honest on the survey questionnaires and during the
delayed retrospective think-aloud (self-report) process.

3. The participants would be honest in indicating any unknown words while reading the text in both environments, computer-based and print-based.

4. The participants could communicate in either their first language or English during the delayed retrospective think-aloud process.

5. The participants would be typical college-level students whose first language was not English and who studied in the United States using English.

6. The participants would not have any prior knowledge of the reading material.

7. If the unknown words indicated by the participants occurred several times, the words would be counted as one occurrence.

8. The instruments for this study would be reliable and appropriate for measuring the participants’ reading performance and vocabulary knowledge.

9. The participants would be able to freely control the computer screen while reading the computer-based texts.

10. The online dictionary in the computer-based text was considered to have the same function as the dictionary in the print-based text.

11. The participants demonstrate their strategic behaviors toward unknown words while reading in both environments as they usually do.

12. Given fundamental differences between print-based and screen-based environments, L2 learners may engage in different kinds of strategic behavior within the two environments.
1.7 Limitations of the study

One of the limitations of this study is that the findings of this study might not be generalizable to larger populations, such as all ESL/EFL learners, in that the subjects in this study have different countries of origin from other learners. Similarly, due to the small number of subjects, the findings of this study might be limited to specific individual learners rather than larger populations. Second, considering both the level of difficulty of unknown words and the length of texts, the frequency of strategy use and types of specific strategy employed by the participants might vary compared to those of other studies. Thus, these two factors (length of text and difficulty of unknown words) need to be taken into account when the results of this study are extrapolated to other research. Third, in addition to the difficulty of the unknown words, the density of unknown words in the text can also have an impact on the learners’ approach to the unknown words (Laufer, 1997). Therefore, the findings of this study might not be generalizable or comparable to other types of texts used in some research, in which some target words are artificially contrived by controlling the number of unknown words and the location of the unknown words. In this sense, special caution needs to be exercised when this study is compared to other studies which include some nonsense target words. The researcher believes that this distinction is important to make for this study on the whole. Lastly, due to practical difficulties, the same reading material was used both for the computer-based and the print-based environments. Thus, there might be some variations pertaining to the participants’ strategic behavior and the number of unknown words that they identified during the two experiments.
1.8 Description of the Study

The participants in the present study were university students, who speak English as a second language (ESL), at a Midwestern university. They all participated in the study voluntarily. They were students in the United States at the time of this study, pursuing either a B.A., M.A., or Ph.D. degree. The participants were from various academic areas of study and countries of origin (Mainland China, Japan, Korea, and Taiwan). Depending on their level of vocabulary knowledge, the participants were divided into three groups: advanced, intermediate, and low groups. In order to measure the participants’ vocabulary knowledge, the participants took a standard vocabulary size test, adapted from the vocabulary levels test (Nation, 1990), the reliability and validity of which has been well-established through many studies (Fraser, 1999; Laufer, 1992).

In order to explore the research questions for this study, specific reading material was developed both for the computer-based and the paper-based reading environments. With regard to the reading material, the selection was an article from the New York Times, entitled “How to Cool a Planet”. This material is generally assumed to be culturally-unbiased and not to be influenced by the participants’ prior knowledge of field-related jargon. The reading material was used for the both computer-based and print-based text samples. To create the same reading conditions related to the texts, fonts, and number of words in each line were the same.

Using this reading material, the data were collected over the course of an academic quarter, approximately three months. The researcher investigated each individual participant’s strategic behaviors in a random order, either implementing the
computer-based text first or print-based text first. The interval between the two different administrations was two or three weeks to lessen the possibility for any effect from the previous administration. In a meeting prior to the tests, for the print-based reading environment, the participants were informed that they could use either an electronic dictionary or a traditional paper dictionary that they brought for this study. In addition, right before the participants were exposed to the computer-based reading environment, they were informed that they could open and use any online dictionary that they usually used.

While the participant read the material, the researcher observed and recorded which strategic behaviors they demonstrated based on the checklist designed for this study by considering taxonomy: ignoring, inferencing, dictionary consultation, and etc. After each administration, the researcher had the opportunity to ask additional open-ended questions of the participants and later conducted semi-structured interviews. This approach aimed to collect information about how each participant typically dealt with the unknown words, the frequency of specific strategy use, and why the participant showed specific strategic behaviors upon encountering the unknown words. Furthermore, through a semi-structured follow-up interview session, the researcher investigated the participants’ additional experiences in dealing with the unknown words. Thus, the researcher collected both quantitative and qualitative data for this study.
CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter introduces a theoretical framework for investigating L2 learners’ strategic approaches to unknown words while reading both computer-based texts and the paper-based texts. Cognitive theory and metacognitive theory both provide a theoretical context for this study, in that language learning processes are believed to be composed of clusters of cognitive and metacognitive strategies in interaction with one another (Macaro, 2006). Furthermore, L2 learners’ cognitive or metacognitive knowledge about reading and vocabulary is related to their lexical processing strategies of unfamiliar words (Fraser, 1997). Within this theoretical framework, this chapter will focus on how L2 learners face the challenges presented by unknown words. It will survey a large body of literature related to L2 learners’ strategic behavior in response to unknown words, discussing topics such as the relationship between vocabulary knowledge and reading comprehension, incidental vocabulary learning through reading, L2 reading in a computerized environment, the role of tools such as glosses and dictionaries, and readers’
lexical processing strategies. The first section of this chapter discusses the theoretical framework followed by a review of previous studies and related literature.

2.2 Theoretical Background

In order to understand how L2 learners cope with unknown words while reading, this study primarily relied on cognitive learning theory and metacognitive processing theory. In a cognitive context, “the information from long-term memory can be used to enrich the learners’ understanding or retention of the new ideas by providing related information or schemata into which the new ideas can be organized” (O’Malley & Chamot, 1990, p. 18). Unobservable cognitive learning processes are essential to language learning in this view (Kim, 2003), and learners’ strategic processes – how linguistic information is processed in human brain – are assumed to be critical processes by theories in cognitive psychology (Fan, 2003; Nassaji, 2004). Moreover, scholars have identified strategies as deliberate, cognitive steps that learners can take to assist in acquiring, storing, and retrieving new information which can subsequently be accessed for conscious report (Paris, Lipson, & Wixons, 1994), involving active human cognition. Therefore, in this study, it is anticipated that learners will attempt to comprehend and interact with text and unknown words through strategic behaviors, or cognitive activities, for productive purposes by developing mental representations of words’ form and meaning upon encountering unknown words (Paribakht & Wesche, 1999; Schmitt, 2000).

This study was also guided by metacognitive processing theory, although the distinction between cognitive and metacognitive strategies is not always clear-cut
(O’Malley & Chamot, 1990). Because learner strategies are conscious or potentially conscious, demonstrating deliberate attempts to gain new information, they can also be illustrated within metacognitive processing theory. According to this view, learners consciously monitor their own learning processes, reflecting on how they learn and evaluating how successfully they are learning, in order to facilitate effective learning (Ellis, 1994). In addition, through metacognitive awareness, or regulation of cognition, learners consciously regulate and select effective learning strategies in association with a set of activities by controlling their learning (Gass & Selinker, 2001). As demonstrated in this study, upon first encountering unknown words, learners are able to recognize which words they do not know (selective attention), consciously monitor which strategies are more effective, and decide which strategy they need to employ in identifying word meanings (Koltun & Biemiller, 1999). In managing the situation in this way, the learners enhance their ability to become successful language learners. Further details of the theoretical backgrounds of each of these theories are as follows.

2.2.1 Cognitive Learning Theory

Constructivism has received growing interest over the past decades as being a theory that is opposed to both behaviorism and maturationism. Behaviorism views learning as “a system of behavioral responses to physical stimuli,” (Fosnot, 2005, p. 8) and maturationism explains learning as “dependent on the developmental state of the learner” (p. 9). Under the constructivist views of learning, on the other hand, more emphasis is placed on the individual learners’ “cognitive structuring process” (p. 28), which is referred to as the cognitive theory of learning.
As in any other learning theory, cognitive theory attempts to explain and focuses on individual learners’ knowledge construction in the process of construing experiences in particular contexts (Palincsar, 1999; Cobb, 2005). It also asserts that “students actively construct their ways of knowing as they strive to be effective by restoring coherence to the worlds of their personal experience” (Cobb, 2005, p. 34). In this sense, within a cognitive theory, perception, memory, inference, and decision appear to play important roles in the acquisition of knowledge of abstract representations and procedures, which can later be applied to contexts (Greeno, 1997).

Cognitive theorists view learning as a process of self-organization. They also define learning as the acquisition of structures that are stored in the memory and can be retrieved and applied in new circumstances (Fosnot, 2005): “Students’ minds are constantly engaged in sorting, collating, and integrating incoming experiences with each other and with prior knowledge in the process of internalization” (Nuthall, 1999, p. 173). According to this perspective, students are active agents, adapting to the actions of others through ongoing negotiation (Cobb, 2005), and classroom interaction is an evolving microstructure that entails the teachers’ and students’ efforts to coordinate their individual activities.

In a similar vein, with respect to SLA, cognitive theory explains that L2 knowledge is inseparable from actual use, and that SLA is not based on abstract linguistic knowledge. Rather, it is based on the extent to which the learner is able to achieve mastery over the formal and functional properties of language and the mental processes involved (Ellis, 1994). The focus of cognitive theory in SLA accounts for the L2 learning
process, in particular, mental processes through which learners can construct knowledge systems that create outputs that are cognitive in nature. Unlike in L1 learning, due to L2 learners’ limited language proficiency and limited exposure to the L2, theorists who belong to the cognitive domain see SLA primarily from the role of instruction, negative feedback, and explicit knowledge in L2 learning (Ellis, 2005), and believe that attention to input determines the internalization of language (Ellis, 1999).

2.2.2 Metacognitive Learning Theory

Metacognitive knowledge means knowledge about “ourselves, the tasks we face, and the strategies we employ” (Garner, 1994, p. 717). Wenden (1999) defined metacognitive knowledge as “what learners know about learning, and to the extent a learner has made distinctions, language learning” (p. 435). In other words, it is learners’ knowledge about themselves, about the purpose and nature of the task, and about when and how to apply appropriate strategies in learning. Metacognitive knowledge enables learners to consciously use three essential skills of metacognitive strategies: planning, monitoring, and evaluation. Metacognitive knowledge also plays an important role in many cognitive activities in language use such as reading comprehension, writing, or various types of self-instruction (Flavell, 1979).

Through the use of metacognitive strategies, learners can monitor or direct the learning of a task, think about the learning process both purposefully and systematically, and modify their future performance (Schraw & Moshman, 1995; Vandergrift, 2000). Furthermore, learners determine choice of composing strategies through the metacognitive knowledge (Wenden, 1999). For example, when a learner reads two
different types of reading materials, such as a textbook and a comic book, the learner knows/decides what the objectives of the specific tasks are - reading for pleasure (the objective can be skimming) or reading for specific information (the objective can be scanning). Then, the learner checks his/her understanding. When the learner cannot achieve the preplanned objectives, for instance, finding specific information while reading the textbook, the learner then tries to find out what existing problems are preventing him/her from completing the task successfully.

By the same token, it is also claimed that learners’ recognition of the need to monitor their own comprehension during reading along with their motivation is crucial for strategic reading and a key to reading proficiency (Paris et al., 1994). Furthermore, the importance of social context and social interaction between teachers and students and among students in improving language learning and reading proficiency is emphasized (Schraw & Moshman, 1995).

2.3 Vocabulary Knowledge and L2 Reading

A widely held view in second language research is that a major obstacle for L2 learners to achieve a high level of reading competence is learners’ limited vocabulary knowledge. When reading academic texts, students need to know the particular meanings of words in order to access and understand information (Pretorius, 2006). The importance of learners’ vocabulary knowledge is particularly obvious in a university context given that the learners who pursue higher education need to know not only general academic
vocabulary\textsuperscript{1} but also technical vocabulary\textsuperscript{2} specific to their own specialized disciplines in conjunction with high frequency words (Alderson, 2007; Hyland & Tse, 2007; Koda, 2007).

Correspondingly, it is unarguable that the larger a readers’ vocabulary size, the higher his or her level of reading comprehension. Although there is some discrepancy among researchers about the size of the vocabulary threshold needed for effective understanding, several researchers (Huckin & Coady, 1999; Laufer, 1992, 1997; Nation, 2001) suggest that the minimum vocabulary required for reading comprehension is about 3,000 word families or about 5,000 or 7,000 lexical items, offering coverage of between 90 percent and 95 percent of any text. Ultimately, learners need to know about 5,000 word families or 8,000 lexical items in order to achieve 98 percent coverage of reading comprehension (Nation, 2001), and based on that knowledge the remaining 2 percent can be easily guessed because a large number of familiar words can facilitate successful guessing. Researchers estimate that learners need to know about 98 percent of the running words in a text when reading for pleasure and 95 percent of the running words when reading for bare necessity (Hirsh & Nation, 1992; Nation, 2001). More importantly, Hazenberg and Hulstijn (1996) estimated that the minimal vocabulary size needed for university studies is at least 10,000 base words.

\textsuperscript{1} Academic words typically cover about 9 per cent of the running words in a text (Nation, 2001).
\textsuperscript{2} Technical words typically make up about 5 per cent of the running words in a text (Nation, 2001).
Numerous studies have supported the critical role of vocabulary knowledge and the inextricable relationship between vocabulary and L2 reading comprehension in the university setting. For example, in one study of sixty-four first year university students who were speakers of Hebrew and Arabic, Laufer (1992) examined how L2 reading was affected by L2 proficiency (learners’ lexical level) and general academic ability, comparing their vocabulary sizes in L2, general academic ability, and L2 reading. The findings revealed that L2 reading may or may not be influenced by the learners’ general ability, although the learners’ L1 skills may contribute to their L2 reading. Better academic ability may play a role in determining the result of L2 reading with learners at a low level of proficiency, who had fewer than 5,000 lexical items. However, there is no overall linear relationship between the learners’ L2 reading scores and general academic ability if the learners are within the vocabulary range of 3,000-4,000 word families (about 5,000-6,500 lexical items). In contrast, a positive correlation was found between learners
at 5,000 word families (8,000 lexical items) and their L2 reading scores, hinting that learners’ general academic ability does not influence their L2 reading. Thus, Laufer asserted that L2 lexical knowledge is a better predictor of reading in L2 than the learner’s general academic ability.

Qian (1999) also conducted an empirical study to explore the relationship between L2 learners’ reading comprehension and vocabulary knowledge, especially the role of depth and breadth of vocabulary knowledge. The participants were eighty adult ESL learners (Chinese and Korean) whose L2 vocabulary size was at the 3,000 word-family level or better. The participants took a vocabulary size test (VS\(^3\)), a depth-of-vocabulary-knowledge test (DVK), and a reading comprehension test (RC). The findings showed that scores on both the VS and DVK were highly and positively intercorrelated with the learners’ general academic reading comprehension levels, indicating that development of the two dimensions is probably indeed interconnected and interdependent. These findings were in line with his extension study (2002) conducted with participants of nineteen L1 backgrounds. Furthermore, although both components (vocabulary size and depth) made significant contributions to scores on reading comprehension, DVK, adding a noticeable 11 percent to RC over and above VS, turned out to make a particularly significant and unique contribution to academic reading comprehension.

Likewise, a recent study also gives support to the earlier studies that suggest a correlation between vocabulary size and reading comprehension. Henriksen, Albrechtsen

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\(^3\) Breadth of knowledge measures primary meaning of words; depth of knowledge, on the other hand, measures knowledge of synonym, polysemy, and collocation (Qian, 1999, 2002).
and Haastrup (2004) explored the relationship between foreign language learners’ L2 vocabulary size and their L2 reading comprehension scores. The participants were thirty tenth-graders and thirty first year university students who were Danish learners of English. The participants took vocabulary and reading tests both in L2 and L1. The findings demonstrated a high correlation between the scores on the L2 vocabulary size test and the L2 reading test for both groups. The learners whose vocabulary test scores were above the general mean achieved scores above the general mean on the L2 reading test and learners with vocabulary test scores below the general mean also scored below the mean on the reading tests. In particular, vocabulary scores above seventy and below ninety in isolation appeared to be a very strong predictor for L2 reading scores in this study. Nonetheless, it is worth noting that Henriksen et al. pointed out a ‘probability zone.’ With this concept, they suggest that not only vocabulary size but other factors, such as lexical inferencing skills and the organizational structure of the lexicon, might play significant roles in the prediction of L2 reading skills, especially in relation to learners whose vocabulary scores are between seventy and ninety.

As an extension of earlier work on the importance of vocabulary knowledge in reading, Morris and Cobb (2003) carried out a study to examine the potential for vocabulary profiles to function as predictors of academic performance in undergraduate Teaching English as a Second Language (TESL) programs. The participants were one hundred twenty-two Canadian TESL trainees in a university. The participants’ entrance exam essays, which were at least three hundred words in length, were used as vocabulary profiles. The study looked for correlations between the vocabulary profiles and the results
from two required grammar courses. The results indicated vocabulary profiles as good potential predictors of the academic performance of TESL students, resulting in significant correlation with grades in the two courses. In addition, the vocabulary profiles appeared to be an excellent means of measuring the English language skills of high proficiency nonnative speakers.

In summary, although reading comprehension is affected by several factors, such as learners’ relative background knowledge, language learning experiences, reading strategies, grammar knowledge, and the type and structure of texts (Devitto & Burgess, 2004; Grabe & Stoller, 1997), “no text comprehension is possible, either in one’s native language or in a foreign language, without understanding the text’s vocabulary” (Laufer, 1997, p. 20). In light of the critical value of vocabulary knowledge in reading comprehension, numerous studies have long supported a strong correlation between learners’ vocabulary knowledge and reading comprehension. As a result, there is a general consensus among researchers that L2 learners’ lexical knowledge is the best predictor of success in reading comprehension (Coady, Magoto, Hubbard, Graney & Mokhtari, 1993; Van Gelderen, Schoone, Stoel, Glopper & Hulstijn, 2007; Golkar & Yamimi, 2007; Haynes & Baker, 1993; Park, 2001).

2.4 Vocabulary Learning and Reading

It is estimated that the vocabulary of the average educated native speaker of English is approximately 20,000 words, and that children acquire about 1,000 words per year (Gardner, 2004; Nagy, 1997; Nagy & Herman, 1987; Nagy, Herman, & Anderson, 1985). Although there is some controversy, it is widely agreed that learners can gain
much of their vocabulary knowledge from encountering new words in context (Jenkins & Dixon, 1983; Kuhn & Stahl, 1998; Parry, 1991; Sternberg, 1987). A large bulk of learners’ vocabulary growth from context relies on several factors, and volume of reading is one such factor, reflecting incidental learning from context. Nagy (1997) argued that although the probability of learning words through a single encounter in context is relatively low, incidental acquisition from context during reading likely accounts for as much vocabulary growth as does instruction. Many researchers in the second language acquisition field also support the idea that much second language vocabulary learning occurs incidentally through extensive reading (Fraser, 1999a; Gass, 1999; Huckin & Coady, 1999). Thus, regular and wide reading can be viewed as a major avenue for large-scale, long-term vocabulary growth (Fukkink, Blok, & Glopper, 2001).

In an attempt to measure whether students acquire measurable knowledge about unfamiliar words while reading a text, Nagy, Herman, and Anderson (1985) conducted an experimental study. The participants were fifty-seven eighth-grade students of average and above average reading ability, and they read either an expository or a narrative text about 1,000 words in length. Based on the findings from interviews and multiple-choice tests, the researchers claimed that statistically reliable gains from both contexts do come from reading contexts: “unmistakable learning from context from one or a very few exposures to unfamiliar words in natural text” (p. 251). Moreover, they point out that the vocabulary growth from learning words from context compares favorably with direct vocabulary instruction, considering the amount of words learned. Consequently, Nagy et al. posited that context provides enough information to help a reader gain a full
understanding of the meaning of a word, not being limited to providing only a vague initial indication of a word’s meaning.

As an extension of this study on learning from context, Nagy and Herman (1987) investigated incidental learning of word meanings during normal reading, using either expository or narrative passages selected from grade-level textbooks. Three hundred fifty-two students in the third, fifth, and seventh grades participated in this study. The results demonstrated a significant degree of learning from context; that is, small but reliable incidental learning of word meanings was shown to take place during normal reading without consistent difference between the narrative and expository texts. Nevertheless, two additional findings need to be mentioned, as they complicate this simple correlation. A text with a higher proportion of conceptually difficult words resulted in fewer words learned from context. In addition, if the sentences were longer and the average length of the target words in a text was longer, fewer words were learned from the context. The degree to which a reader can integrate information from a passage into a coherent system with his or her prior knowledge is the most important factor in learning from context. Thus, Nagy and Herman argued that learning from context was most strongly influenced by the proportion of unfamiliar words that were conceptually difficult as well as the average length of unfamiliar words.

Gardner (2004) also explored the importance of the reading materials to which learners are exposed. Though previous studies had not detected a discernable difference between different kinds of texts in vocabulary learning, he postulated that the nature of reading materials (lexical differences) can have a profound effect on children’s overall
reading experiences and vocabulary learning opportunities in that the narrative and expository registers utilize vocabulary in very different ways. An analysis of the distribution of vocabulary in two kinds of reading materials (narrative and expository) revealed marked differences between the two with regard to overall token distribution and individual type repetition. For example, narrative texts tend to emphasize the social and cultural contexts of human interaction and human characteristics, such as emotions, expressions, and physical features. Expository texts, on the other hand, are more informational, scientific, and content-based in nature. In addition, the difference between the two types of texts is largest at the more specialized levels of vocabulary in which the potential for large-scale vocabulary acquisition is the greatest. Therefore, Gardner asserted that while wide reading can be a viable explanation for large vocabulary growth through the academic years, both register and thematic issues in that reading need to be considered. In other words, although similar specialized word forms may appear in both kinds of reading materials, acquired meanings may be highly dissimilar, depending on the nature of the reading materials. Consequently, Gardner argued that claims of incidental vocabulary acquisition through repetitive encounters with unknown words while reading large volumes of material for pleasure may be too simplistic.

Also focusing on the relationship between particular kinds of texts and vocabulary acquisition, Carver (1994) explored how the percentage of unknown words in a passage varies with its relative difficulty for elementary school students (two hundred nineteen students in grades 3, 4, 5, and 6) as well as sixty graduate students. One hundred-word passages were given to the elementary school students, and one hundred twenty word
passages of varying difficulty levels (junior high, senior high, college, and graduate school) were given to the graduate students. The findings demonstrated that close to zero percent of basic words will be unknown when the reading material is relatively easy for the reader; one percent will be unknown basic words when the difficulty of the reading material is matched closely to the ability of the reader; and two percent or more will be unknown basic words when the reading material is relatively hard. Thus, Carver argued that in terms of increasing vocabulary, free reading is likely a waste of time. Few new words will be added through easy reading because easy reading (free reading) may increase depth of vocabulary knowledge, but it is not likely to increase breadth of vocabulary. He also claimed that in order to increase their vocabulary students must read books above their independent level in that the percentage of unknown words varies with the relative difficulty.

Meanwhile, Horst, Cobb, and Meara (1998) explored L2 learners’ vocabulary learning through focused extensive reading. The participants were thirty-four low-intermediate learners in an intensive English program in Oman. A teacher in this study read aloud the entire text, *The Mayor of Casterbridge*, to the learners rather than a simplified. The findings showed conclusive evidence that small but significant amounts of incidental vocabulary learning occurred in all reading, but that a longer reading treatment produced more evidence of word learning. Reading a full-length book can facilitate more word learning and build more strong associations between new words than simplified text. Furthermore, learners are more likely to pick up words that are repeated often in a text (sizable gains can occur consistently for the words that are repeated eight
times or more) and this is increased in longer texts. However, the point to be made here is that Horst et al. asserted that extensive reading is not a very effective means to extend vocabulary for, in particular, low-intermediate learners, who have around 3,000 words, in that these L2 learners cannot read in sufficient volume, requiring a great deal of time to achieve vocabulary learning.

However, some researchers have questioned a widely acknowledged belief that L2 learners’ vocabulary growth occurs through input, with reading as a major source of vocabulary acquisition. For instance, Laufer (1991) conducted an experimental study to explore empirical evidence for a relationship between the growth of productive vocabulary and both uncontrolled input and learners’ language level. Forty-seven university students participated in this study. Thirty-five of the participants were native speakers of Hebrew, and twelve were native speakers of Arabic. In order to examine the learners’ progress in lexical richness, researchers analyzed several of the learners’ free compositions over two semesters. The findings indicated that there was no significant progress in lexical richness except for in below-average level of vocabulary students.

Some learners, on the other hand, actually regressed in their active vocabulary, which can suggest that the learners develop a strategy of “playing it safe” by using a limited stock of words with which they are most familiar. As a result, Laufer suggested that it is the needs of the learner that result in active vocabulary enrichment rather than comprehensible

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4 Chun and Plass (1996) argued that the chance is very small that L2 learners or readers would remember the meaning of a word that occurs only once in a text, postulating that incidental learning of vocabulary seems to span the range from only 5 percent to 20 percent.
input (lectures by native speakers and academic reading material). She further argued that input will be ineffective until the learners’ lexicon will reach the average level.

Similarly, in a later study, Laufer (2003) carried out three experiments on the place of reading in vocabulary growth. The first experiment compared the number of words retained after a reading activity with the number of words retained after writing isolated sentences by sixty EFL university students, divided into a sentence writing group vs. a reading activity group. The findings showed that the sentence writing group significantly outperformed the other on both an immediate and a delayed vocabulary test. The second experiment was conducted to compare the number of words retained after a reading activity with the number of words retained after incorporating these words into a composition, studying eighty-two advanced university EFL learners of English. The findings showed that the composition group recalled significantly more word meanings than the reading group on both immediate and delayed tests. The third experiment compared the number of words retained after three tasks: reading and looking up an unknown word in the dictionary; writing sentences with the target words; and completing sentences with the target words after looking up their meaning. The results revealed that learners in the reading group who used dictionaries remembered significantly fewer words than the other two groups on both the immediate and the delayed test. In addition, the sentence completion group yielded the highest scores on the delayed test. On this basis, Laufer claimed that reading alone is not the best source of vocabulary acquisition, and that when learners practice a word in a productive word-focused task, they
remember its meaning better than when they encounter it in a text or look it up in a dictionary.

To sum up, a considerable amount of research has shown that there is no doubt that learners incidentally gain small but substantial amounts of vocabulary knowledge in the course of reading, either extensive reading or intensive reading. These small amounts of knowledge can become big if learners read large quantities of text while accumulating exposure to the words in various contexts (Stoller & Grabe, 1993). However, some studies have challenged a default explanation of incidental vocabulary learning while reading. In other words, incidental vocabulary learning can vary depending on other factors, such as the nature of reading materials, the number of exposures to a word, or learners’ proficiency levels.

2.5 Computerized Learning Environment

The involvement of technology in language learning has developed rapidly. Educators have adopted new technologies as institutional resources and sources of knowledge. Pedagogical researchers have also become increasingly interested in the area of technology use, especially in relation to reading (Coolege, 2004). Blake (1992) suggested that a computer’s potential as a tracking tool in reading research is evident, and that “vocabulary acquisition seems to be the most immediate area where computers can facilitate an exploration of the second-language learner’s behavior” (p. 22). This interest has focused on several related issues such as differences between conventional reading

5 In this study, computerized learning environment is used as a cover term to refer to all new learning environments related to use of a computer (online text), such as the Internet, multimedia environments, hypertext, Computer-Assisted Language Learning (CALL), web-based learning, web-based learning, etc.
and computerized reading environments, learners’ attitudes toward the computerized reading environment, and the use of online dictionaries or glosses. Numerous empirical studies have shown the benefits of computerized reading, illustrated language learners’ positive attitudes towards using a computer in their studies, and provided positive feedback from language learners and educators.

For instance, according to Son’s (2007) study, ESL learners demonstrated positive attitudes toward language learning through the use of computers and web-based activities, agreeing that they prefer that web activities be a regular component of their language courses. They considered the web a tool to practice language skills and a supplementary resource for successful comprehension of language, providing an extensive range of authentic materials and a more learner-centered medium of learning. Also, they believed web-based language learning activities were valuable with regard to accessing information, receiving instant feedback, and allowing them to work by themselves.

Lim and Schen (2006) investigated EFL learners’ perceptions of different reading environments: CALL-based reading classes and traditional reading classes. The subjects, seventy-four first year English major students in Korea, were evenly divided into two groups for one semester of teaching. In relation to the students’ perceptions of different learning environments in reading, the students in the CALL-based English class showed more positive perceptions of their environment than those in the traditional English class. In particular, the students in the CALL-based class showed a significantly more positive perception of the feedback they received, evidenced greater interest, and more strongly
recommended the course to other students. Thus, Lim and Schen suggested that computer technology has a positive impact on students’ perception of their learning environment.

Teachers (specifically Korean secondary school EFL teachers) also showed favorable perceptions or attitudes toward the use of the Internet. The results of a survey with one hundred one Korean secondary school EFL teachers indicated that they perceived the Internet as a useful teaching tool, and they considered the Internet a rich learning environment that provides valuable resources for EFL instructors (Shin & Son, 2007). In addition, the teachers assumed that students can be motivated and improve their language skills through the use of the Internet, which provides the possibility for students’ self-directed learning. The findings of this study are in accordance with several other studies (Brantmeier, 2003; Loucky, 2005).

Moving beyond measuring perception to measuring actual learning, Tseng (2008) compared EFL learners’ reading of hypertext and printed text in terms of reading comprehension and how participants inferred the meaning of unknown words. Forty-six Taiwanese students were divided into two groups. Participants in the experimental group read the text in the form of a computer hypertext and the control group read the printed text. The findings demonstrated that participants in the control group performed better in reading printed text than those in the experimental group in reading comprehension, which requires skimming and scanning skills. However, participants in the experimental group performed better than those in the control group on vocabulary questions that required them to guess unknown words from the context.
In the meantime, Tozcu and Coady (2004) explored the effect of using CALL for direct vocabulary learning on vocabulary knowledge and reading comprehension. The participants in the experimental group using CALL studied approximately 2,000 high frequency English words on the computer. On the other hand, the students in the control group spent the same amount of time reading print texts and doing reading comprehension exercises. The results revealed that the students in the experimental group performed significantly better in reading comprehension than those in the control group. In addition, although both groups showed increased reading comprehension, the students in the experimental group learned a significantly larger number of words than those in the control group. That is, students’ learning of high frequency English words on the computer leads to a significant improvement in reading comprehension over using print resources. Thus, Tozcu and Coady argued, “individualized vocabulary learning on the computer will almost certainly facilitate vocabulary acquisition” (p. 491).

In a similar study, Al-Jarf (2007) investigated the effects of teaching vocabulary online to EFL college students. The participants were fifty-three female freshman students enrolled in their first vocabulary course in Saudi Arabia. The participants were exposed to both traditional in-class vocabulary instruction and to online instruction. The results of the scores of a pretest and a posttest indicated that online instruction had a significant effect on vocabulary development. The students’ achievement correlated with the frequency of their contributions to discussion topics and questions posted in the online course. Not only the good and average performing students but also the lowest
performing students improved their achievement in vocabulary. Furthermore, the study also reported students’ positive attitudes toward online instruction.

However, the studies also reported some conflict or controversy with what can seem like an overwhelmingly positive portrait of online vocabulary learning. For instance, with regard to the EFL learners’ eventual reading performance in two different reading environments (CALL-based reading classes and traditional reading classes), Lim and Schen (2006) found no significant difference between those in the traditional English class and in the CALL-based English class: CALL-based teaching does not seem to be different from traditional classroom teaching. Also, an important point to be mentioned from Tseng’s (2008) study above is that the participants in the experimental group commented that they felt nervous about reading English on the computers, including uncomfortable physical responses, and about the absence of notes and marks, which seemed to impede their reading comprehension on the computer screens. Other studies also mentioned weaknesses of online reading. For example, Son (2007) pointed out that web-based language learning offers a lack of interaction and an inability to adapt to individual differences among learners. Ayres’ (2002) investigation also showed that although participants considered CALL important and extremely useful for their studies, they thought that the classroom-based learning was “more motivating, more useful in all skill areas, more adaptable and relevant” (p. 249).

In summary, a substantial amount of research on the use of technology in L2 learning, particularly in reading, has supported clear and positive evidence of the value of computer mediated language learning. Multimedia materials were reported to offer
additional sources of supportive information for L2 learners. Not only do learners exhibit positive attitudes toward reading on the computer in conjunction with their preference for online versions of texts, but educators also view Computer Assisted Language Learning (CALL) as valuable resource for learning. More importantly, studies have found that computer mediated language learning can enhance learners’ vocabulary learning and reading comprehension, though some studies also hint that learners need to be already familiar with the online learning environment in order for their learning to be enhanced.

### 2.6 (Online) Glosses in Reading

Vocabulary glosses are common in L2 instructional materials both to assist reading comprehension and to aid vocabulary learning (Nation, 1990). Readers can receive immediate access information (even to images) to facilitate reading comprehension through the use of glosses or annotations. Glosses appearing in a first language or a target language in the form of marginal notes can also help readers with figuring out unknown words while reading. Unlike dictionaries, glosses are usually contextualized, lessening the burden of disambiguating the supportive information (Cooledge, 2004). Also, unlike a traditional printed reading environment, the computerized reading environment creates the possibility for extensive glosses that do not impede the reading process since the glossed items are invisible until the reader clicks on the target word. Hence, some researchers have pointed out that probably the most attractive and noticeable advantage of the online reading environment over print is its ability to provide L2 readers with glosses in a multimedia format (Jacob, 1994). Considering the properties of glosses in reading stated above, it is not surprising that the
majority of studies in this area argue for the usefulness, value, and effect of glosses in different formats/modalities to promote reading comprehension and vocabulary retention (Busch, 2003).

Regarding L2 vocabulary glossing and its effect on online reading comprehension, Lomicka (1998) compared twelve college students, enrolled in a French course, under three test conditions: participants in condition A (no glossing) had access to definitions in French, translations in English, images, references, questions, and pronunciation guides; participants in condition B (limited glossing) had access to definitions in French and translations in English; and participants in condition C (full glossing) read a text with no access to glosses. According to this study, even though participants in C condition could get access several types of informational glosses, they stated a strong preference for the traditional definitional glosses (limited glosses). It is assumed that learners consciously use glosses to achieve minimal levels of comprehension, oriented toward the goal of translation and paraphrasing. However, the findings also demonstrated that multimedia annotations (full glossing), compared to no glossing or limited glossing, may have a positive effect on comprehension, promoting a deeper level of comprehension.

Some studies provide positive evidence for the effect of marginal glosses as a way of enhancing vocabulary learning through reading. Watanabe (1997) explored the effects of text modification (vocabulary explanation) and task on incidental vocabulary learning. Two hundred thirty-one students in Japanese universities participated in the study. The participants in the treatment groups received a passage with target words underlined and were instructed to write the meaning of the target words in Japanese. The other non-
treatment groups answered comprehension questions on the same passage with target words not underlined. The vocabulary explanation for the treatment groups was provided in three ways: appositives, marginal glosses, and multiple-choice marginal glosses (MC glosses). The scores demonstrated that participants with marginal glosses and MC glosses significantly outperformed those in the original and the appositive conditions in the immediate and delayed posttests. More specifically, participants in the marginal gloss condition significantly outperformed than those in the MC gloss conditions. Surprisingly, contrary to expectations, the activities of choosing the better alternative from the MC glosses and writing the native language translation of the target words had no significant influence on students’ performance on the vocabulary posttests.

Similarly, Chun (2001) carried out an empirical study to investigate how L2 learners of German access information while reading, specifically examining twenty-three second year students’ behavior in looking up unknown words and the metacognitive strategies of the readers in a Web-based learning environment. The Web-based environment for this study included a program-internal glossary, an online bilingual dictionary, and an audio narration of the text. The findings showed that students looked up significantly and extensively more words in the internal program vocabulary glosses than the external online dictionary; however, the students looked up fewer words in the bilingual dictionary. Furthermore, although hypermedia does not necessarily facilitate learner comprehension in general, this study suggested that students read and understand a text better when they have access to both the internal glosses and to an external dictionary than when they have access only to an external dictionary. Thus, it is assumed
that an internal glossary can be beneficial to L2 reading online due to its ability to offer instantaneous vocabulary help. It is also important to consider that L2 readers tend to look up unknown words immediately whenever they encounter them if this can be done quickly and simply.

Laufer and Hill (2000) investigated the relationship between lookup behavior using an electronic dictionary and the number of words remembered. The participants were thirty-two EFL students in Israel and forty first-year ESL students in Hong Kong. The findings, through a pre-test and retention test, demonstrated that different people had different lookup preferences, and that the use of multiple dictionaries reinforced retention of the words looked up. Specifically, the Chinese learners looked up the words almost twice as often as the Israeli learners. While the Chinese learners also opted to look up English meanings of unfamiliar target words (English) rather than L1 translations, Israeli learners much preferred using the L1 translation exclusively. Furthermore, the Chinese learners remembered many more words than the Israeli group, suggesting that the use of L1 together with L2 resulted in better word retention. Thus, Laufer and Hill claimed that incidental vocabulary learning can occur under optimal lookup conditions since learners can select the lookup strategy most compatible with their learning style.

Abraham (2007) conducted a study to examine the effects of pictorial (videos, images) and verbal (Spanish definitions, English translations) glosses/annotations on vocabulary learning and comprehension with one hundred two students (sixty-one female and forty-one male) in an intermediate-level Spanish course. The participants were divided into three groups: a control group has no access to glosses, a choice-lookup group
with access to verbal and pictorial glosses, and a forced-lookup group required to consult all available verbal and pictorial glosses. The findings indicated that the choice-lookup and forced-lookup groups significantly outperformed the control group on both a productive vocabulary posttest and a summary task. However, an important point that emerged in this study is that there was a significant negative correlation between the number of times students looked up video annotations and their performance on the vocabulary posttest. In addition, the number of times students in the choice lookup group used L1, L2, and picture annotations did not necessarily enhance or impede their reading comprehension.

Chun and Plass (1996) carried out similar research to explore the effects of different types of multimedia annotations (text only, picture + text, and video + text) on vocabulary acquisition and to examine the behavior of learners with computerized dictionaries, using a group of one hundred sixty German university students in the U.S. The findings indicated the participants scored higher for words that had picture + text annotations than for words with only definitions or with video + text glosses. The participants reported that the picture glosses provided more retrieval cues than the other types of annotations. With regard to look up behavior, there was no correlation between total number of words looked up and performance on the vocabulary tests. In other words, “high frequencies of words looked up do not necessarily result in better performance on a vocabulary tests” (p. 192). However, it is worth noting that when annotations were provided, there was a greater likelihood of incidental learning of vocabulary words (between 24.1 percent-26.5 percent) than without annotations. In this regard, providing
annotations in different modalities appears to reinforce vocabulary learning in that learners look up a word more than once.

Al-Seghayer (2001) examined which image-based modalities (dynamic video or still picture) are more effective in aiding vocabulary acquisition. Thirty ESL student participants were provided with a variety of glosses or annotations, including printed texts, graphics, video, and sound for words in order to aid in the understanding and learning of unknown words. The findings demonstrated that the participants performed better in both recognition and production vocabulary tests when the words had textual definitions as well as video than when the words had text only definitions. The participants who studied words with only printed textual annotations scored the lowest. In addition, the participants remembered words better with text and video annotations than words with text and picture. This study also demonstrated that a video clip with a text definition is more effective in teaching unknown words than a picture with a text definition.

Sakar and Ercetin (2005) found similar results regarding the use of multimodal definitions. According to their study, participants consistently and significantly preferred visual annotations to textual and audio annotations, and they rated the visual annotations as highly useful. The participants also revealed positive attitudes towards annotations and hypermedia reading; however, there was a negative relationship between annotation use and reading comprehension. That is, reading comprehension appears to be negatively correlated both with the frequency of access to annotations and the amount of time spent on annotations. Thus, this negative relationship casts doubt on the usefulness of
annotations for reading comprehension. Furthermore, participants tended to look up even familiar information or words due to easy and excessive access to annotations.

Some studies have reported contrasting findings in this area. Jacobs (1994) explored the effect of vocabulary glossing on reading comprehension for L2 learners. One hundred sixteen U. S. college students enrolled in a Spanish course participated in this study. They were divided into two even groups, one group reading an unglossed Spanish text and the other group reading the same text accompanied by English glosses. The participants were asked to write as much of the text as they could recall after reading the text. The findings revealed that glossing produces a significant degree of recall of the text because glossing substantially increased students’ recall of the text. The interaction between glossing and time spent reading was also significant, though there was no significant interaction between other independent variables (frequency of gloss use, perceived usefulness of glosses, proficiency, etc.) and glossing. However, it is important to note that glossing did not seem to enhance reading comprehension. The difficulty of the text, the readers’ proficiency, the number and choice of items glossed, and other factors determine the effect of glossing on the improvement of reading comprehension. Thus, Jacob pointed out that the use of glosses should not be the readers’ first choice when they faced a comprehension breakdown since the use of glosses would deny students the opportunity to practice strategies they will need to use much more frequently with unglossed texts.

Ariew and Ercetin (2004) explored whether different types of hypermedia (electronic) glosses/annotations facilitate reading comprehension (of expository text) with
eighty-four intermediate and advanced adult ESL learners. The participants were divided into two groups: group A was provided with contextual annotations, such as definitions of words, and group B was provided with textual annotations, such as background information about the topic in the form of video or audio annotations. The findings showed that the participants perceived annotations (definitions of words) as highly useful for comprehension; however, there was not a clear-cut relationship between annotation use and reading comprehension for either group. Learners, on the other hand, tend to direct their attention to the different types of information based on their interest or the mental effort required for a type of information rather than based on the usefulness of the annotation. In addition, it was pointed out that the availability of annotations, especially video annotations, might actually hinder reading comprehension. In particular, for the intermediate group, there was a negative relationship between the time spent on video and graphics annotations and reading comprehension.

Similar findings were reported in other studies as well. Davis and Lyman-Hager (1997) asserted that computerized glosses appeared to have no effect upon better comprehension. Frantzen (2003) also claimed that glossing did not appear to have either a valuable or critical impact on word learning. In particular, if the glosses provided were for phrases rather than for individual words or if an incorrect synonym was supplied in a gloss, glossing can actually cause misunderstanding of word meaning. In addition, she argued that students learn approximately the same number of glossed as unglossed words when glosses do not capture the full meaning of words or phrases.
To sum up, although there are conflicts, most studies have found that glosses, with their obvious benefits, contribute both to reading comprehension and to vocabulary learning. More specifically, since glosses supply accurate meanings for unknown words that might not be guessed correctly, they have positive effect on reading comprehension and may encourage vocabulary learning. In addition, a large body of research has substantiated that learners prefer visual glosses to either text only or audio glosses, and that these forms of glosses also result in better comprehension and vocabulary learning. However, some contradictory findings are worth mentioning. For instance, some evidence suggests that glosses can be a distraction in that learners tend to look up the glossed words more frequently than they need to, even with familiar words.

2.7 Dictionary Use in Reading

Dictionaries can be used for a wide range of purposes and can help learners with understanding text and vocabulary learning. Consulting a dictionary needs to be viewed as a lexical processing strategy which enhances L2 reading comprehension and vocabulary learning capabilities (Fraser, 1999b). Although the amount of vocabulary learning relies heavily on individual differences (Fraser, 1999b), those who use a dictionary almost always learn more words than those who read without a dictionary (Laufer, 2000). However, traditionally, dictionary use is usually considered to be the last step taken to obtain the meanings of unknown words while reading (Nist & Olejnik, 1995; Schatz & Baldwin, 1986) and there are some doubts about the effect of a dictionary on reading comprehension and vocabulary. For example, in many cases the reader will not be able to choose the correct alternative (Van Parreren & Schouten-Van Parreren, 1981).
It is also very time-consuming, impractical, or impossible to use a dictionary to check every unknown word (Albus, Thurlow, Liu, & Bielinski, 2005; Roskams, 1998), disrupting the comprehension process. Given the value of consulting a dictionary in reading comprehension and vocabulary learning, a body of research has been conducted to explore the use of dictionaries in language learning.

In an effort to investigate the contribution of dictionary use to language learning, Luppescu and Day (1993) carried out a study focusing on the effect of the use of bilingual dictionaries on vocabulary learning while reading. The participants were two hundred ninety-three Japanese university students and they were divided into two groups, a control and a treatment group. The findings of the vocabulary test after reading showed that using a dictionary clearly had a significant effect on students’ performance on the test. The mean score of the dictionary group was considerably higher than that of the group that did not use dictionaries, supporting the claim that the use of a bilingual dictionary can facilitate indirect or incidental vocabulary learning. However, the study points out that using a dictionary while reading causes a decrease in reading speed. The students in the dictionary group read at an average rate of eighty-eight words per minute; whereas, the students in the no-dictionary group read at an average rate of one hundred fifty-six words per minute. Furthermore, Luppescu and Day argued that the use of a dictionary in some cases may be misleading or confusing, especially if a student is not able to select the appropriate meaning from among the possible meanings listed.

Knight (1994) carried out a study to explore the effect of dictionary use on reading comprehension and vocabulary acquisition, depending on the learners’ verbal
ability, with one hundred twelve Spanish university students. The findings revealed that
dictionary lookup enhanced comprehension, especially for low ability groups, showing
that dictionary lookup does not hinder reading comprehension. However, the effects of
dictionary lookup for students of high verbal ability seemed to be questionable. That is,
there were no significant differences for the high verbal ability groups both in the
dictionary and the no-dictionary conditions; on the other hand, low verbal ability students
in the dictionary group significantly outperformed the students in no-dictionary
conditions. Thus, low verbal ability students benefited from the dictionary more than high
verbal ability students. With regard to vocabulary acquisition, the participants using the
dictionary learned more words than those who guessed from context, and high verbal
ability students learned more words than low verbal ability students. Accordingly, Knight
argued that dictionary use should be encouraged for low verbal ability students, and that
these students need to improve their ability to derive meaning from context because they
are at disadvantage when simply guessing from context.

Laufer (2000) investigated vocabulary acquisition under electronic dictionaries,
which provided L1 translation, L2 definition, example of usage, or combinations of these.
Fifty-five university EFL students in Israel participated in the study. The findings,
through both an immediate recall test and a delayed test, indicated that learners
performed significantly better when they selected a combination of translations,
definitions, and examples in the long-term recall scores, suggesting that combining
dictionary information in two languages reinforces retention.
Likewise, a recent study examined the usefulness of and learners’ lookup preferences for different types of dictionaries (Laufer, 2006). Four dictionary types were compared on the number of correct translations and on dictionary ratings: a paper bilingualized (L1-L1-L2) dictionary (P-BLD), an L1-L2 paper bilingual dictionary (P-BD), an L1-L2-L2 paper bilingual dictionary plus (P-BD+), and a computerized bilingual dictionary plus (C-BD+). The participants were seventy-five university students in Israel.

In terms of effectiveness for a text-production task, the findings revealed the superiority of the BD+ over the other dictionaries. Both the paper and the electronic dictionaries proved the most effective, yielding correct translations eighty percent of the time. The learners also reported the BD+ was the most helpful for the writing task they performed. Their prevalent lookup pattern was translation+definition+example, which indicated that learners used the combination of the bilingual and monolingual information most often. In addition, the electronic BD+ was valued more than the paper version by the learners.

In summary, some studies have raised concerns about dictionary use in L2 reading. For instance, dictionary use takes time and some learners appear to spend more time on dictionary use than they need to. In addition, learners might have difficulty in selecting appropriate meanings in the dictionary. However, generally, dictionary use has a demonstrated positive impact on vocabulary learning and reading comprehension, particularly for low-level learners. Furthermore, an important point to be made here is that consulting in combination with inferencing has the greatest positive effect on reading and vocabulary learning. Lastly, the use of a bilingual dictionary can be more effective than that of a monolingual dictionary.
2.8 Glosses and Dictionaries

With the widespread use of technology in language learning, researchers have investigated and compared which form of dictionary, either electronic or conventional, best enhances language learning, reading comprehension, and vocabulary learning. Leffa (1992) conducted an experimental study to assess the efficiency of the electronic glossary on reading comprehension with a group of forty-three beginning EFL university students in Brazil. They were divided into two groups, one using an electronic glossary and the other using a traditional dictionary. The findings indicated that the electronic glossary was significantly superior to the traditional dictionary for beginning students. Learners with the electronic glossary performed significantly better than those with the traditional dictionary in reading comprehension. The study also revealed that the electronic glossary was more efficient, allowing the learners to access more meaning in less time, which suggests that the electronic glossary may also facilitate acquisition of foreign languages. The results also lend support to Laufer’s (2000) study, which indicated that the learners in the electronic (computer) gloss conditions performed significantly better than those in the paper gloss conditions on retention scores.

In a companion study, Aust, Kelley, and Roby (1993) compared the use of hyper-reference and conventional dictionaries with regard to consultation frequency, study time, efficiency, and comprehension for eighty undergraduate Spanish language learners. The findings revealed that there was no significant difference in reading comprehension between the hyper-reference group and the conventional dictionary group, which was also true of between the bilingual dictionary group and the monolingual dictionary group.
However, the learners in the hyper-reference group consulted their dictionaries much more frequently than those who used conventional dictionaries. With regard to the conventional dictionaries, some benefits of bilingual dictionary use were found. Whereas bilingual dictionary users consulted more often than monolingual dictionary users, bilingual dictionary users also spent less time in reading than monolingual dictionary users. Thus, it was suggested that bilingual dictionaries can enhance reading in language learning to a greater extent than monolingual dictionaries. Furthermore, efficiency was also higher during bilingual dictionary use than monolingual dictionary use, though it is important to note that the study still supported the notion that monolingual dictionary use can contribute to vocabulary growth.

Another study compared the influence of marginal glosses, dictionary use, and reoccurrence of unknown words on incidental vocabulary learning (Hulstijn, Hollander, & Greidanus, 1996). The participants were seventy-eight Dutch first-year advanced learners of French at Dutch universities. They were divided into three groups to read a French short story in one of three text reading conditions: marginal glosses (provision of L1 translations of unknown words), dictionary (opportunities to use a bilingual dictionary), and a control group receiving no additional information. The findings showed that overall the participants provided with marginal glosses outperformed the dictionary group in a retention test. They performed twice as well as or better than the dictionary group. Although the participants in the dictionary group rarely used their dictionaries, there was a greater probability that the participants would remember a word’s meaning once they looked up the word than the average retention for the marginal
glossary group. Thus, this study supported the notion that frequency of occurrence will foster incidental vocabulary learning more when the meanings of unknown words are provided through marginal glosses or when learners look up meanings in a dictionary.

To sum up, growing attention among L2 researchers has been paid to the effectiveness of electronic dictionary and conventional dictionary use. Most studies have suggested that electronic dictionaries appear to be superior to the conventional dictionary for reading and vocabulary learning. In addition, the use of an electronic dictionary is reported not to interrupt the reading process, as compared with the conventional dictionary, allowing for beginners to read more text with greater comprehension and reducing studying time.

2.9 Lexical Processing Strategies

The process of vocabulary acquisition is not only one of the most laborious and challenging aspects of foreign/second language learning but it is of critical importance to L2 learners (Zimmerman, 1999). Acquiring an adequate L2 vocabulary appears to be a very time-consuming task (Kelly, 1992) and L2 learners’ limited vocabulary causes one of the strongest discrepancies in reading performance, as compared with native English speakers (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006). Considering the many difficulties the L2 learner confronts in reading, as stated above, the use of appropriate lexical processing strategies seems to be of great importance. As in any other learning process, learners use various strategies upon encountering unfamiliar words while reading. That is, lexical processing strategies are viewed as especially critical in reading and useful for dealing with low-frequency words (Nation, 2001).
Many researchers have set out to identify and classify the lexical processing strategies used by learners. Fraser (1999) pointed out that if an unknown word does not appear to hinder comprehension, it is normally ignored; on the other hand, if the unknown words seem to have a great contribution to determining meaning, a variety of strategies are used to disambiguate them (Kaivanpanah & Alvi, 2008). Given the importance of lexical processing strategies and the possible variety in the responses of various readers, an abundance of vocabulary strategy classifications have been developed. Because of the infeasibility of describing all of the different classifications that have been proposed, this study will present in detail two major classifications – Gu and Johnson’s (1996) and Schmitt’s (1997) – though it will reference others in the following descriptions of various studies.

In an attempt to establish the relationship between L2 learners’ (Chinese university students) vocabulary learning strategies and outcomes, Gu and Johnson (1996) developed a list of vocabulary learning strategies. The list consists of eight major strategies: learners’ beliefs about vocabulary learning, metacognitive regulation, guessing strategies, dictionary strategies, note-taking strategies, rehearsal strategies, encoding strategies, and activation strategies. Seven (with the exception of activation strategies) of the eight strategies are divided into multiple subcategories. Beliefs about vocabulary learning include the ideas that learners should memorize words, acquire vocabulary in context, and learn vocabulary and put it to use. Metacognitive regulation involves selective attention and self-initiation. Guessing strategies span immediate context and wider context. Dictionary strategies include comprehension, extended dictionary
strategies, and looking-up strategies. Note-taking strategies consist of meaning-oriented note-taking and usage-oriented note-taking. Rehearsal strategies include using word lists, oral repetition, and visual repetition. Encoding strategies include association/elaboration, imagery, visual encoding, auditory encoding, using word structure, semantic encoding, and contextual encoding.

| (Learners’) Beliefs                      | Words should be memorized                          |
|                                        | Acquire vocabulary in context                        |
|                                        | Learn vocabulary and put it to use                   |
| Metacognitive Regulation               | Selective attention                                   |
|                                        | Self-initiation                                       |
| Guessing Strategies                    | Wider context                                         |
|                                        | Immediate context                                     |
| Dictionary Strategies                  | Comprehension                                         |
|                                        | Extended dictionary strategies                        |
|                                        | Looking-up strategies                                  |
| Note-Taking Strategies                 | Meaning-oriented note-taking                          |
|                                        | Usage-oriented note-taking                             |
| Rehearsal Strategies                   | Using word lists                                      |
|                                        | Oral repetition                                        |
|                                        | Visual repetition                                      |
| Encoding Strategies                    | Association / Elaboration                             |
|                                        | Imagery, Visual encoding, Auditory encoding           |
|                                        | Using word-structure, Semantic encoding, Contextual encoding |
| Activation Strategies                  |                                                        |

**Table 2.2**: Vocabulary learning strategies (Gu & Johnson, 1996)
On the one hand, Schmitt’s (1997) categorization of lexical processing strategies for discovering new meaning has five categories: determination strategies, social strategies, memory strategies, cognitive strategies, and meta-cognitive strategies. Determination strategies include gaining a meaning of a new word based on the word’s part of speech, root or affixes, L1 cognates, or textual context. Social strategies refer to the strategies that allow learners to “interact with other people in order to discover or practice new words” (Wa-Mbaleka, 2006, p. 73). Asking a teacher for an L1 translation, paraphrase or synonym, or asking classmates for a word’s meaning belongs to the category of social strategies. Memory strategies involve “relating the word to be retained with some previously learned knowledge, using some form of imagery, or grouping” (Schmitt, 1997, p. 211). Some of the memory strategies are studying a word with a pictorial representation of its meaning, associating the word with its coordinates, or grouping words together within a storyline. Cognitive strategies, which are similar to memory strategies, refer to strategies “to manipulate or transform the target language” (Wa-Mbaleka, 2006, p. 73). Verbal/written repetition, word lists, keeping a vocabulary notebook, or taking notes in class are cognitive strategies. According to Schmitt, many learners with high levels of proficiency use these cognitive strategies. Lastly, meta-cognitive strategies are used “to control and evaluate their own learning, by having an overview of the learning process in general” (Schmitt, 1997, p. 216). Using English-language media or skipping or passing new words belongs to the category of meta-cognitive strategies.
| Determination Strategies | Analyze part of speech, affixes, and roots  
Analyze any available pictures or gestures  
Check for L1 cognate  
Guess from textual contexts  
Bilingual/monolingual dictionary  
Word lists, flash cards |
|-------------------------|------------------------------------------------------------------|
| Social Strategies       | Ask teacher for an L1 translation, paraphrase, synonym of new word, or a sentence including the new word  
Ask classmates for meaning  
Discover new meaning through group work activity  
Study and practice meaning in a group  
Teacher checks students’ flash cards or word lists for accuracy  
Interact with native-speakers |
| Memory Strategies       | Study word with a pictorial representation of its meaning, the spelling of a word, or the sound of a word  
Image word’s meaning or word form  
Connect word to a personal experience or its synonyms and antonyms  
Associate the word with its coordinates  
Use semantic maps or ‘scales’ for gradable adjectives  
Peg/loci method  
Group words together to study them  
Group words together spatially on a page or within a storyline  
Use new words in sentences  
Say new word aloud when studying  
Underline initial letter of the word  
Configuration  
Use keyword method, cognates in study, or semantic feature grids  
Affixes and roots or parts of speech (remembering)  
Paraphrase the word’s meaning  
Learn the words of an idiom together  
Use physical action when learning a word |
| Cognitive Strategies    | Verbal/written repetition  
Word lists, flash cards  
Take notes in class, keep a vocabulary notebook  
Use the vocabulary section in your textbook  
Listen to tape of word lists  
Put English labels on physical objects |
| Meta-Cognitive Strategies | Use English-language media (songs, movies, newscasts, etc.) or spaced word tests  
Testing oneself with word tests  
Skip or pass new word  
Continue to study word over time |

Table 2.3: Vocabulary learning strategies (Schmitt, 1997)
Baker (1989) explored the possibility that readers’ responses to unknown words change as a function of readers’ developmental level and as a function of the characteristics of the unknown words. In two experimental studies, findings indicated that younger readers (thirty third graders) were most likely to focus on word length and least likely to focus on meaning in judging how disruptive an unknown word is to overall comprehensibility. In contrast, (twenty-seven) college students were more likely to focus on meaning. On the one hand, (fourteen) fifth graders’ response patterns were not significantly different from either the third graders’ or the adults’, which suggested that the fifth graders were apparently in a state of transition. Therefore, Baker suggested that the ability to evaluate whether or not an unknown word seriously hinders comprehension is a late-developing skill.

In the mean time, Gu and Johnson (1996) examined vocabulary learning strategies and the relationship between strategies and outcomes in association with participants’ beliefs about learning English, for eight hundred fifty non-English major university students in China through a questionnaire and a vocabulary size test. The findings showed that the participants used more meaning-oriented strategies than rote strategies, not relying on memorization, which is contrary to widespread beliefs about Asian learners. Also, learners used a wide range of vocabulary learning strategies. Self-initiation and selective attention appeared to be positive predictors of general English proficiency. Specifically, contextual guessing, use of dictionaries, note-taking, paying attention to word formation, and intentional activation of new words were positively correlated with vocabulary size and general English proficiency. In terms of the learners’
perception, the lowest performing group of several groups strongly believed in the usefulness of memorization and visual repetition of word lists. It is important to note that oral repetition is positively correlated with general proficiency; however, visual repetition of new words is strongly negatively correlated with vocabulary size and general proficiency.

Some discrepancies were found between the frequency of use and perceived usefulness of L2 learners’ vocabulary learning strategies. Fan (2003) explored frequency of use, perceived usefulness, and actual usefulness of L2 learners’ vocabulary learning strategies for first-year college students in Hong Kong. The findings indicated that of nine categories of vocabulary learning strategies (management, sources, guessing, dictionary, repetition, association, grouping, analysis, and known words), guessing unknown words is the most often used strategy, and grouping, association, and management are the least often used strategies among the L2 learners. However, although the learners used guessing more frequently than the dictionary strategy, the learners perceived a considerable number of dictionary strategies as more useful than guessing strategies. In addition, in relation to learners’ proficiency, the study revealed that while less proficient learners used repetition and association strategies most often, the most proficient learners used guessing, dictionary, and known words strategies significantly more often than other strategies. The study also reported that certain strategies appear to be more relevant than others to learning words at related frequency levels. That is, dictionary use is a useful strategy for learning both high- and low-frequency words. Guessing strategies, on the other hand, appear to be most useful for
learning high-frequency words (2,000-3,000 word level) and exploiting sources seems to be very useful for learning low-frequency words (5,000 and 10,000 word levels).

In a similar study with a more qualitative design, Porte (1988) used structured interviews to explore fifteen under-achieving EFL learners’ strategies for dealing with new vocabulary. The results of this study demonstrated that poor language learners use very similar strategies (such as overt and covert use of repetition in vocabulary learning, the writing out of translation equivalents, and the use of dictionaries) to those of good language learners in dealing with new vocabulary. Besides that, the participants’ present and past language learning experiences appeared to affect their use of the strategies. The participants indicated that they use strategies that were the same as, or very similar to, those they had used at school in their native countries. They also picked up strategies from other students or strategies being already used in other subject areas in the school rather than learning strategies directly from their teachers. From this study, Porte suggested that poor language learners do not need merely to copy their instructors; rather, teachers/educators need to help the poor learners to identify, nurture, and refine their own current repertoire of learning strategies in order to make them more efficient.

Similarly, Arden-close (1993) compared L2 readers’ strategies for dealing with unknown words within a series of six readings related to chemistry. The participants, divided into three groups (good readers, average readers, and poor readers), were thirty-nine second year students of chemistry at the University of Oman. The findings showed that all the students, even the weakest, sometimes employed their word knowledge in conjunction with minimal use of the context surrounding a word to intuit its meaning.
Only the strongest students considered contexts larger than a paragraph, and they made use of a wider range of strategies than the weaker students. The weakest students, on the other hand, made use only of the immediate sentence, clinging to the words they knew, and they were more likely to go on the ‘look’ of an unknown word to decide its meaning, although the meanings they obtained this way were sometimes against the sense of the context. It is important to note that all the students, even strong students, were easily distracted by the ‘look’ of a word from considering context, despite the fact that the appearance of the word could be highly misleading.

Harmon (1999) investigated the vocabulary learning strategies two proficient readers employed to understand unfamiliar words in self-selected reading. The participants (Marian and Shawn) were L1 English seventh-graders in a literature-based reading classroom. The results indicated that the two participants used multiple strategies to figure out unfamiliar words, such as making use of distant and local context, drawing on different types of content connection, doing word-level analysis, using syntactically appropriate synonyms, and using a dictionary. More specifically, they used previous text information in association with an adherence to the local context to figure out unfamiliar words; however, they rarely made references to information beyond the text. The researcher pointed out that flexibility and variability in making connections as well as in activating strategies characterized the two participants’ behavior in constructing word meanings, a concept which was substantiated in another study (Parry, 1993, 1997).

Parry (1993, 1997) carried out a case study with a Greek man (Dimitri) and a Korean woman (Ae Young) to investigate how L2 learners deal with nonspecialized
words in an anthropology book. The findings revealed a striking difference between the two students (holistic or analytic) in spite of their similar level of language proficiency. For example, Dimitri, demonstrating a holistic style, read much more and found fewer words to be difficult. Only a small portion of the words which were difficult for him appeared frequently. Furthermore, he was relatively successful in guessing unknown words. On the other hand, Ae Young, demonstrating an analytic style, read through texts only once, stopping on each unknown word and spending a long time working out the word’s meaning. When she discovered the definition of the words, she went back to the context, reconstructing her interpretation based on the definition she had found. Considering the striking differences between the holistic and analytic approaches to vocabulary, Parry argued that learners need to develop flexibility in adapting approaches in that both approaches are useful but neither is appropriate at all times.

Fraser (1999) explored L2 learners’ lexical processing strategies and the impact of the strategies on vocabulary learning. The three strategic options were ignore and continue reading, consult a dictionary or another individual, or infer word meaning on the basis of linguistic and contextual cues. Eight Francophone university students participated in the study. The participants received explicit metacognitive strategy training, focusing on developing awareness of the use and viability of the three strategic options. The findings indicated that the participants tended to infer more frequently than they ignored or consulted when encountering unknown words. The participants inferred in fifty-eight percent of the cases; they consulted a dictionary thirty-nine percent of the time; and they ignored unfamiliar words thirty-two percent of the time. The findings also
revealed that the instruction focusing on enhancing lexical processing strategy use did not have a direct effect on vocabulary learning, and the learners’ proficiency did not affect the retention of the meaning of new words. However, the learners demonstrated a higher retention rate when they inferred and then consulted rather than exclusively inferring based on L1 or L2 word association.

In a similar vein, Paribakht and Wesche (1999) also explored what strategies learners used when they attempt to understand the unknown words they encountered while engaging in two comprehension tasks (a question task and a summary task), using introspective and retrospective think-aloud data collection techniques. The participants were ten intermediate-level ESL university students from a variety of L1 backgrounds. The results showed that the participants tended to ignore a large proportion of the words (approximately half) they identified as unknown. For the words the participants attended to, they used three different strategies: word retrieval, appeals for assistance, and inferencing. Of the three strategies, inferencing, which accounted for almost eighty percent of strategy use, was the main strategy the participants employed. In addition, with regard to the type of knowledge in lexical inferencing, there were noticeable individual differences in the knowledge sources used, which appeared to be related to individual’s previous L2 learning experiences, their L1, and the topic familiarity of the texts. Of the knowledge sources, sentence-level grammatical knowledge was the most often used in both tasks (summary and question) and for all word categories. Furthermore, the readers’ perception of the overall difficulty of the text had a strong impact on whether they attempted to infer word meanings.
Likewise, Qian (2004) conducted a study with sixty-one Korean or Chinese ESL learners to investigate ESL learners’ preferred behavior upon encountering unknown words, their preferred lexical inferencing strategies, as well as their perceptions and their actual application of lexical inferencing. The findings demonstrated that guessing meaning from context upon encountering unknown words is the most predominant and popular behavior, followed by looking up the word in a bilingual dictionary. Asking the teacher for assistance or asking a friend for assistance is the most infrequent behaviors. In addition, global meaning (use of the meaning of the paragraph or text as a whole) and word knowledge are the top two most-preferred categories of strategies. However, there is a significant difference between learners’ actual lexical inferencing practices and their self-reported strategies. More specifically, syntagmatic cues and morphological cues are the most frequently used strategies in the learners’ actual approaches, rather than global meaning and world knowledge, which were self-reported as the most popular strategies by the learners.

In summary, specific strategies, as a part of general learning strategies, are important tools for learners in the language learning process. They are also particularly useful to L2 learners given that there are many different kinds of unknown words that should be checked while reading. Considering L2 learners’ limited vocabulary knowledge, a substantial amount of research has focused on learners’ lexical processing strategies. Several studies have reported that inferencing, ignoring, and looking up in a dictionary are the most frequently employed strategies upon encountering unknown words while reading. However, some studies have pointed out that there are differences
between the most useful strategies as perceived by learners themselves and learners’ most frequently employed strategies.

2.10 Studies on Vocabulary Inferencing

It is estimated that an average fifth-grade student encounters between 16,000 and 24,000 unknown words annually (Nagy, Anderson, & Herman, 1987). Average students can derive the meanings of approximately 3,880\(^7\) of these 20,000 unknown words (Jenkins, Matlock, & Slocum, 1989) during reading. In spite of the fact that all the meanings derived while reading are not necessarily retained, readers’ ability to derive meaning can considerably affect vocabulary learning, which may be the first step toward learning new words. Also, this ability to derive meaning is of critical importance for L2 learners, considering L2 learners’ challenges in learning vocabulary. Thus, guessing about word meaning is essential and happens naturally in reading (Bensoussan & Laufer, 1984). However, inferring is not always an easy or efficient strategy for L2 learners to use either because of text complexity or because of reader limitations (Fraser, 1999a).

Given the critical role of guessing in reading and learning new words, important research has explored factors which have considerable impact on inferencing strategies, such as learners’ proficiency and the unknown word’s context, or lack of it (Nagy, 1997; Nagy & Herman, 1987; Perkins & Brutten, 1983; Schatz & Baldwin, 1986).

\(^6\) Inferencing and guessing are used interchangeably in this study.

\(^7\) In emphasizing students’ deriving ability, Jenkinson et al. (1989) assumed that average students can derive meaning for 2,120 of 20,000 unfamiliar words encountered annually when students can derive meanings at a ratio of .106 and 3,880 words annually at a ratio of .194.
For instance, McKeown (1985) compared the process of inferring meaning of new words and acquiring word meaning from context for high- and low-ability students. The participants were thirty fifth-grade children. According to the result, there is significant difference in identifying the correct meaning of the target words across ability level. For instance, low ability students were much less likely to succeed in gaining meaning from context, and their process of gaining meaning from context was far from an automatic process, due to frequent misunderstanding of the relationship between the word and the surrounding context. They appeared to be impaired in deriving word meanings from context, particularly when working from multiple contexts, and were less able to test a meaning choice within constraints identified from context. They also directly transferred meaning inferred from one context into another, which hinders an accurate evaluation of the second context. This resulted in, in turn, a disadvantage in deriving word meaning and in applying the new word with irrelevant information. Thus, McKeown argued that inferring and learning word meaning from context is affected not only by information available in the context but also by factors such as “weeding out irrelevant information, integration of information gleaned into a coherent word meaning, and usefulness of prior knowledge” (p. 494).

Roskams (1998) examined L2 learners’ use of inferential strategies and their effectiveness of dealing with unknown words while reading in English through think-aloud protocol. Seventeen first year university students with a reasonably good command of English in Hong Kong participated in this study. The results demonstrated that students tended to use multiple clues in inferencing unknown words in conjunction with
flexibility. The most commonly used clues were local context (sentence level), depending on the word and information available about the word. On the other hand, using syntax and/or morphological clues seemed to be the most effective strategies to arrive at a correct inference. In contrast, one apparent cause of failure in inferencing was due to the fact that learners ignored important words and textual clues from the particular context; they demonstrated an inability to employ strategies, especially to a local context where they encountered a word. In addition, the use of word association clues also resulted in incorrect influences.

Chikalanga (1993) investigated L2 learners’ performances on different types of inference questions with both familiar (Zambian-based) and unfamiliar (British-based) tests. The participants were one hundred forty-four grade eight and one hundred fifty-six grade ten students in Zambia. The results revealed that the upper grade students performed significantly better than the lower grade students on both the Zambian and the British inference tests. Furthermore, both the upper and lower grade students performed significantly better on the Zambian-based test than on the British-based test. From this study, Chikalanga pointed out that learners’ ability to infer improves with age, and that prior knowledge on a topic not only influences L2 readers’ ability to draw inferences but also their ability to deal with textually-constrained inferences.

This indication is in line with Pluido’s study (2007). Pulido (2007) examined the impact of topic familiarity and passage sight vocabulary (vocabulary knowledge associated with texts) on lexical inferencing and retention using two contrived narrative passages, one describing a more familiar scenario and on a less familiar scenario. Thirty-
five adult learners of Spanish at a university, native speakers of English who completed a L2 passage sight vocabulary test, participated in the study. Approximately one week after reading the passages individually, each participant completed the accompanying lexical inferencing and difficulty rating tasks. The findings demonstrated that there was a consistent, significant effect for topic familiarity and its positive effect on the perception of ease/difficulty in lexical inferencing. When participants scored at least sixty-seven percent on the passage sight vocabulary measure, the participants were able to significantly more easily guess new words from the more familiar passage than those from the less familiar passage. Although learners with a wide range of passage vocabulary were able to correctly infer and retain some degree of semantic knowledge about new words, the less familiar topic made it more difficult for them to guess. That is, even knowing ample vocabulary from the less familiar passage did not compensate for the lack of familiarity with the topic when guessing about meanings of new words.

Carnine, Kameenu, and Coyle (1984) conducted a descriptive study examining the effects of form and proximity of contextual information on students’ learning of unfamiliar words. Twenty-seven fourth-grade, forty-one fifth-grade, and forty-six sixth-grade students participated in the study. The findings showed that the students scored significantly higher on the words-in-context test than on a simple vocabulary identification test. More specifically, when unfamiliar words appear in context, determining the meaning of unfamiliar words is easier. When the contextual information is in synonym rather than inference form, and contextual clues are simpler and closer to
the unfamiliar word, deriving word meaning from context also seems to be easier. Furthermore, older students had correct answers more often than younger students.

Likewise, Fukkink, Blok, and Glopper (2001) conducted a cross-sectional study to examine learners’ ability to derive word meanings from context. The participants were thirty Dutch first-language learners from grades 2, 4, and 6 (ten students in each grade) in the Netherlands. Twelve target words were morphologically nontransparent to deriving word meaning from external context and evenly divided into concrete and abstract words. The findings revealed that the ability to derive word meaning from context was related to the student’s grade and the concreteness of concepts. Concrete concepts make it easier for students to infer word meanings than abstract concepts. Students’ definitions of words contained thirty-eight percent of the correct attributes, and learning occurred for both concrete and abstract words with forty-two percent and thirty-four percent of correct attributes, respectively. Younger students, who especially experienced problems with abstract words, had more false attributes. In terms of contextualization, students appeared to glean only partial word knowledge from context and to decontextualize their definitions more often with increasing age, which hints of a developmental trend.

In the meantime, Bensoussan and Laufer (1984) explored whether better students use context more effectively than weaker students in guessing unknown words in EFL reading comprehension. The participants were sixty first-year university students in Israel divided into three groups: good, average, and weak groups. First, the students were given a list of seventy words to translate into their L1 (‘in isolation’). A week later they received a copy of the same word list with the addition of a text containing all the words
(‘in context’) to see the effect of context surrounding the tested words. The results showed that regardless of learners’ level of proficiency, context did not help learners much in successfully inferring the meaning of unknown words (in context), suggesting that the students either did not use the context to intuit meaning or did so unsuccessfully. In addition, the findings showed that in this study good students do not guess differently from weak students. The strength of the good students can be attributed to their better word knowledge and their prior knowledge rather than to superior guessing strategies. The students’ most typical strategy with unknown words was ignoring them. Other than this strategy, the commonest strategy was the application of students’ preconceived notions, which were often wrong or did not make any sense in the given context, about the meaning of words or phrases.

Nassaji (2004) examined the relationship between L2 learners’ depth of vocabulary knowledge, their lexical inferencing strategy use\(^8\), and their success in deriving word meaning from context, conducting the study using introspective think-aloud protocols. Twenty-one intermediate ESL learners in Canada (Chinese, Spanish, Persian, Portuguese, and Arabic) participated in the study, and they were divided into two groups, lexically skilled and lexically less skilled students. The findings revealed that the degree to which the learners used different strategies was significantly related to their degree of lexical proficiency. There was a significant difference between the groups both in terms of the type of strategies the learners used and in terms of how effectively they used them. For example, more lexically skilled learners, who had more depth of

\(^8\) In this study, Nassaji identified and classified three main categories of strategy types for inferencing: identifying, evaluating, and monitoring strategies, following Pressley and Afterback (1995).
vocabulary knowledge, made more frequent and effective use of evaluative and context-based strategies in conjunction with verifying, self-inquiry, and section repeating than those who were lexically less skilled. The findings also pointed out that depth of vocabulary knowledge was a much stronger predictor of lexical inferencing success than degree of strategy use - the degree and effectiveness of the strategic inferencing attempts are heavily mediated by the learners’ depth of lexical and semantic knowledge. That is, learners’ depth of vocabulary knowledge played a critical role in inferential success, which is also confirmed by another study (Qian, 2005).

Similarly, Kaivanpanah and Alavi (2008) explored the effects of texts’ syntactic complexity on inferencing word meaning and the relationship between level of language proficiency and EFL learners’ inferencing ability in syntactically simple and complex texts. Participants were one hundred and two (forty-two male and sixty female) undergraduate speakers of Persian. The findings revealed that the level of text difficulty influences ability to infer meaning of unknown words. The participants were more successful in inferring the meaning in syntactically simple texts. It was also found that participants’ proficiency level influenced their lexical inferencing—limited proficiency learners were less adept than proficient learners in using contextual clues to determine the meaning of unknown words. In other words, the contextual clues may disambiguate the unknown words, be unfamiliar, and be of no use to learners of limited L2 vocabulary knowledge. Through this study, the researchers emphasized change in learners’ perceptions that the exact meaning of word is not necessary for comprehension. When
learners hold this view, they remain satisfied as long as their inferences make sense in the
text whether the meaning is right or wrong.

There is some controversy about the nature of lexical guessing in context, and
several studies have argued over the role of context in inferencing word meanings. For
instance, Schatz and Baldwin (1986) contended that the effect of context on inferring
meanings of unknown words is not significant—indeed, using context clues may be an
unreliable means of inferring word meanings since context clues can provide misleading
information about the meanings of unknown words. They conducted an experimental
study to investigate the extent to which context helps students infer the meanings of
unknown words in a naturally occurring context. The participants in experiment one
consisted of one hundred and one students in grades ten (fifty-three) and eleven (forty-
eight) in Florida. Two tests, a words-in-context test and a words-in-isolation test, were
administered. According to the results, there were no significant differences between the
no-context group and the context group, which indicated that students either could not or
chose not to use context to infer the meanings of unknown words. That is, context is an
ineffective or little-used strategy for helping students to infer meanings of low-frequency
words in non-contrived, naturally occurring prose passages. Besides that, the more
information the word contributes to the passage, the less likely it is that context clues will
work. In line with these findings, Kelly (1990) suggested that readers seldom arrive at the
correct meaning through contextual guessing alone “unless the context is very
constrained, which is a relatively rare occurrence, or unless there is a relationship with a
known word identifiable on the basis of form and supported by context” (p. 203).
Frantzen (2003) also claimed that vague and ambiguous contexts do not lead to accurate inferencing of the meanings of target words. She investigated context characteristics and learner behaviors that hinder L2 learners from deriving correct word meanings from a natural, intact, and unmanipulated text. The participants were eleven students in a third-year university Spanish grammar class in the United States. Two pretests and two posttests (no-context and with-context posttests) were administered to compare the students’ ability to infer meanings of unknown words. The findings demonstrated that the students could infer correctly less than thirty percent of the unknown words provided in context. Students were sometimes inattentive to details in context not only when reading passages were difficult but also when they were very easy. In addition, the physical appearance of a word seemed to be a stronger influence than context clues. Students attempted to guess the unknown words according to similar-looking words in Spanish and English and used morpheme analysis (real or imagined) in the absence of context. Thus, the researcher argued that a combination of context factors, student factors, and text factors determine whether learners are able to infer the meaning of unknown words from context.

Similar claims were made by Nassaji (2003). In a previous study, Nassaji (2003) examined the use of strategies and knowledge sources in L2 lexical inferencing and their relationship with inferential success through introspective methods. The participants were twenty-one adult ESL learners (ten male and eleven female) in Canada. With regard to successful inferences, the results demonstrated that overall the rate of success was low. More than a half of the time, students were completely wrong in their attempts to infer
the meanings of unknown words from context. Besides that, the physical form of the words and how they looked seemed to impact the learners’ inference success. With respect to strategies in inferencing, the learners used repeating most frequently of all the strategies: analogy, verifying, monitoring, self-inquiry, and analyzing. This study emphasized that successful inferencing may be the result of how effectively the use of strategies is combined and coordinated with the use of other sources of information in and outside the text. Accordingly, it can be concluded that lexical inferencing also relies on learners’ language and comprehension skills, the types of tasks and texts they encounter, and the nature of the unknown word, as well as a host of other individual and learner-related variables and differences.

To sum up, as L2 learners face unknown words while reading, it is widely acknowledged that inferencing is the most predominant strategy they use, and that vocabulary can be retained while attempting to infer word meanings from context. However, some serious problems learners might encounter in using context for inference have been raised. Researchers have argued that quite often context is ambiguous and is not a reliable factor in successful inferencing. In addition, some studies have suggested that there are other factors that have impact on successful inferencing other than context, such as learners’ depth and breadth lexical knowledge in conjunction with learners’ language proficiency, the physical appearance of a word, and the level of text difficulty.

2.11 Chapter Summary

Given the pivotal role of achieving reading proficiency in learning, reading has long been the focus of attention for researchers and educators. This is especially
important for L2 learners who study in a L2 learning environment, in that “reading is a primary means by which academic knowledge is transmitted” (Huckin & Bloch, 1993, p. 154). Considering the value of L2 learners’ lexical knowledge in reading comprehension and challenges that L2 learners confront in learning L2 vocabulary, researchers have paid great attention to how L2 learners cope with unknown words while reading.

Following the growing use of technology in learning in the past decades, the adaptation of technology to supplement reading has also drawn many researchers’ interest. Research has been carried out on the effect of technology in reading and vocabulary learning on topics such as learners’ perceptions or attitudes toward different learning environments (paper-based vs. computer-based) or learners’ strategy use in the two reading environments.

In this context, this review of literature surveyed different perspectives on the inextricable relationship between reading comprehension and lexical knowledge, the importance of learners’ strategic behavior encountering unknown words while reading, and the effect of technology on learning. However, in spite of the importance of reading ability, lexical knowledge, strategies for dealing with unknown words, and the learning environment, previous studies on these problems have been limited. Their findings have been confined to a superficial level because of heavy use of surveys, their focus primarily on a specific limited number of strategic behaviors, or their taking place not in a natural setting. In addition, up to now, few studies have reported any findings on L2 learners’ strategic behaviors toward unknown words according to different reading environments by comparing the two reading environments (paper-based vs. computer-based). Thus, this
study aimed to develop a fuller understanding of the effect of different reading environments on L2 learners’ strategic behavior coping with unknown words. Furthermore, to offset possible limitations uncovered by previous studies, this study employed a mixed methodology, quantitative and qualitative methods (delayed retrospective think-aloud process and semi-structured interviews), which will be described in great detail in the next chapter. The two approaches were assumed to present a more extensive level of understanding of the research questions for this study.
CHAPTER 3

METHODS

3.1 Introduction

In an attempt to investigate the effects of reading environments (computer-based and print-based texts) on L2 readers’ strategic behaviors toward unknown words, this chapter describes the methodological framework of the study. The methodological framework involves methods of data collection (participants, instruments, and data collection procedures) and the analysis of the data gathered in this study. With regard to the methods of data collection, the study employed a mixed methods approach through both quantitative and the qualitative data gathering methods. Through these two approaches, the study addressed the following overarching research question—Does reading environment (computer-based and print-based) have any effect on L2 readers’ strategic behaviors with respect to unknown vocabulary? The study also addressed the following set of more narrowly focused research questions:

1. What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ level of lexical knowledge (advanced, intermediate, and low) in their strategic behavior toward unknown word meanings?
2. What are the differences/similarities of the effects of reading environment, computer-based and print-based, between L2 undergraduate students and graduate students in their strategic behavior toward unknown word meanings?

3. What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ country of origin in their strategic behavior toward unknown word meanings?

4. What are the L2 learners’ perceptions of their employing strategic behaviors (ignoring, inferencing, dictionary consultation, etc.) in dealing with unknown words in association with two different reading environments?

With these research questions and the purpose of this study in mind, this chapter begins with a rationale for both the quantitative and qualitative methods, including delayed retrospective think-aloud process and semi-structured interviews. This is followed by a description of participants selected for this study. A description of the instruments used for data collection is followed by the explanation of data collection procedures. Then, data analysis procedures will be presented.

3.2 Rationale for the Methodology

As mentioned earlier, the purpose of this study was to explore the effects of reading environments (computer-based and print-based texts) on L2 readers’ strategic behaviors toward unknown words. In order to answer research questions 1, 2, and 3 (L2 learners’ strategic behavior toward between computer-based texts and print-based texts), the quantitative methodology was employed. This methodology made it possible to count
and statistically analyze the frequency of the strategic behaviors employed by the participants. It was felt that this kind of numerical data would provide an appropriately detailed sense of their strategic behavior. Coupled with the statistical analysis of the data, this would make it possible to generate meaningful claims about how second language students respond to such environments. However, it was also felt that relying only on numbers regarding the frequency of the participants’ strategic behaviors would provide a limited picture of the situation under investigation in this study. That is, the quantitative procedures would tell only part of the story.

Despite the value of quantitative research, data about frequency would provide only a superficial portrait of the participants’ strategic behaviors and attitudes. In other words, the quantitative approach to knowledge would function in a monologic or unidirectional way and thus would not capture the full picture of how and why students approached these environments as they did. Based on the frequencies alone, it would also be difficult to speculate meaningfully about reasons for either differences or similarities among the participants. Hence, as a way of compensating for the limitations of the quantitative methodology, employing a qualitative methodology appeared to be necessary. Through the qualitative methodology, more in-depth and useful answers to the research questions could be obtained, as the qualitative data would allow for more individualized accounts to be generated. More specifically, both delayed retrospective think-aloud (DRTA) and the semi-structured follow-up interviews were expected to elicit the most stable and richest data across participants in relation to the learners’ strategic behaviors (Fraser, 1997).
The participants’ verbalization of their thoughts during the DRTA process also enabled the researcher to have more direct access to the learner processes (Haastrup, 1991), in that DRTA is a way of verbalizing participants’ thoughts or feelings right after performing a reading task. This process makes explicit what is implicitly present in participants performing the reading task. As a result, through DTRA, the researcher could “look for observations on thinking that would allow tracing the intermediate steps of the thought processes. Thus, the participants’ verbal reports on their thinking would appear to be a major source of information about detailed steps of the thought process” (Ericsson & Simon, 1987, p. 24). Accordingly, this process could make the participants’ verbal thoughts “more complete and to make the interpretation of the reports more reliable by asking information to make more explicit what they had hinted at earlier” (Ericsson & Simon, 1987, p. 86).

In light of this, a retrospective interview, as a supplement, could also make a valuable contribution not only to better understanding the findings of the quantitative methodology but also to overcome some limitations, if any, of the DRTA process. That is, the semi-structured interviews could help unearth those variables, if any, that existed in relation to reader-based factors. In this way, the participants’ perceptions of or attitudes toward dealing with unknown words across the environments and their strategic behaviors while reading in general could be uncovered. Therefore, the researcher felt that these qualitative methods were appropriate not only to help address research questions 1, 2, and 3 by supplementing data obtained from the quantitative methods, but also by directly answering research question 4.
As stated earlier, employing both quantitative and qualitative methods appeared to be of necessity for this study: each added different ways of generating useful findings, while each had limitations (Hinchman, 2005) that were compensated for by the other. The quantitative approach was critical to identify overall tendencies and investigate whether there would be any differences or similarities between groups or within all of the participants as one group. The qualitative approach allowed the researcher to explain the participants’ strategic behavior and the characteristics of their strategic behavior by observing, describing, and confirming certain behaviors that they otherwise would not report because the quantitative approach would not allow that. Furthermore, the detailed interviews made it possible to explore the reasoning by which students arrived at their patterns of strategic behaviors in tandem with fine-grained reader-based factors. For these reasons, the researcher considered both methods can come into play in complementing each method.

### 3.3 Participants

The participants in this study were thirty-four college students who were enrolled at a Midwestern university in the United States at the time of data collection. They voluntarily participated in this study as either undergraduate or graduate students. Those who finished secondary school in an English speaking environment were excluded from the participant selection. In other words, all of the participants were nonnative speakers of English whose time of study in North America began at the college level. They came from several countries of origin—Mainland China, Japan, Korea, and Taiwan-- and fields
of study. Each participant who participated in each phase of data collecting was given some incentive (approximately $10 per hour).

Pertaining to size of the research population, the use of 34 participants in this study seemed reasonable, bearing in mind other studies similar to this study and employing both quantitative and qualitative methods through meeting twice. For instance, Fraser (1997) selected 8 out of 19 participants for the qualitative section of his study, and 8 case study subjects among 85 participants were selected for the actual study in Cooledge (2004). Kobayashi (2006) selected 22 out of 279 participants for her retrospective think-aloud sessions, and 20 of 62 participants were selected for qualitative purposes in Bengeleil’s study (2001). In addition, all 34 participants in this study were included in the qualitative as well as quantitative sections, so that the total number of qualitative participants outnumbered those in the previous studies just cited. Thus, for these reasons, the number of participants for this study appeared to be feasible.

The 34 participants in the first phase took the Vocabulary Levels Test (see Appendix A) to determine their level of lexical knowledge (and were placed into advanced, intermediate, and low groups) and filled out the background information questionnaire (see Appendix B). After that, they read either a computer-based or print-based text during the first of two reading sessions. During this session, they also participated in the delayed retrospective think-aloud process (DRTA). The same 34 participants were included in phase two, which was composed of both the second reading session (delayed retrospective think-aloud process) and the follow-up interview process. In the second reading session, half of the participants, who read the print-based text in the
first reading session, read the computer-based text, and vice versa for the other half of the participants. After the reading session in this phase, the participants were interviewed individually by the researcher. Figure 3.1 depicts the data gathering process and the number of participants involved.

34 Participants: Vocabulary Levels Test Session

34 Participants: Delayed Retrospective Think-Aloud Process Sessions (1\textsuperscript{st} & 2\textsuperscript{nd})

34 Participants: Retrospective Individual Interview Session

**Figure 3.1:** Number of participants for each session

### 3.4 Data Collection Instruments

In this section, the instruments designed and used for the data collection, such as Vocabulary Levels Test, reading text, text presentation, checklist for strategy use, participants’ background information questionnaire, delayed retrospective think-aloud process, and semi-structured interview will be presented.
3.4.1 Vocabulary Levels Test (VLT)

As a way of assessing the participants’ level of lexical knowledge, the researcher administered a Vocabulary Levels Test (VLT). The VLT, as a measure of general or academic English vocabulary size, was originally proposed by Nation (1983) and republished in a book (1990) in order to give an estimate of vocabulary size for L2 learners. Nation (2001) stated that “the test is designed to be quick to take, easy to mark and easy to interpret” (p. 21). In addition, the VLT can “provide a profile of a learner’s vocabulary, rather than a single figure estimate of overall vocabulary size” (Schmitt, Schmitt, & Clapham, 2001, p. 58).

This test involves word-definition matching such that the definitions are the test items instead of the words; thus, the test-takers are required to match the words to the definition, leading to as little reading as possible and reducing the chances of guessing correctly. Furthermore, in order to prevent providing any grammatical clue as to the correct definition, the words in each cluster are of the same part of speech and are de-contextualized (Golkar & Yamimi, 2007). In other words, the VLT is intended to measure word knowledge without requiring the test-takers to distinguish between semantically related words. For these reasons, the VLT is widely known and respected in the field of vocabulary assessment, and a number of studies have provided positive evidence in relation to its validity and reliability (Read, 2000).

With regard to the format of the VLT, it is composed of five parts with reference to the word frequency in English, representing five levels of word frequency. The levels are 2000 words, 3000 words, 5000 words, the academic word level (beyond 5000 words),
and 10000 words. The 2000 and the 3000 word levels are considered to include high-frequency words that all learners need to know; the 5000 word level demonstrates the upper limit of general high-frequency words; the Academic word level is designed to help students read academic reading material; and the 10000 word level also covers the more common low-frequency words.

The VLT was later revised and proposed by Schmitt, Schmitt, and Clapham (2001). According to the researchers, this second version of the VLT, which functions equivalent to the first version, also shows high validity, reliability, and practicality. For instance, the reliability of the second version of VLT for all word levels ranges between .922 (2000 word level) and .960 (Academic word level). It is also worth noting that reflecting the distribution of other word classes, such as General Service Test, the words of each level fall into a 3 (noun):2 (verb):1 (adjective) ratio (Schmitt, Schmitt, & Clapham, 2001). The second version of the VLT has 10 clusters in each level, and each cluster has 60 words and 30 definitions. Thus, the test has 150 items, involving 75 nouns, 50 verbs, and 25 adjectives in the whole test. The following is an example from the 3000 word level.

1. blanket
2. contest
3. generation
4. merit
5. plot
6. vacation
As can be seen from the example, a test-taker finds and matches the three appropriate definitions on the right with the six items on the left.

The VLT used for this study was the second version revised and proposed by Schmitt, Schmitt, and Clapham (2001). For this study, the second version of the VLT with the 3000 word level, the 5000 word level, the academic level, and the 10,000 word level was employed. Grounds for not administering the 2000 word level VLT were two fold: first, as it is well known, the 2000 word level is the easiest level of the five levels, involving the highest frequency words; thus, it was assumed that most participants would demonstrate good command of knowledge in relation to the 2000 level. This assumption made sense according to the findings of Schmitt et al.’s study (2001). That study revealed that vocabulary profiles for even the weakest student ranged from 77% at the 2000 word level, 33% at the 3000 word level, to 17% at the 5000 word level, 8% at the Academic, and 0% at the 10,000 word level. On the other hand, the profiles for the strongest students ranged from 100% for the 2000, 3000, 5000 word levels, the academic word levels to 80% for 10000 word level. Another study demonstrated similar results: most participants obtained a perfect score at the 2000 word level (Kim, 2003). Thus, not administering the 2000 word level in this study did not distort the findings of the participants’ level of lexical knowledge.

Second, knowledge of the 3000 word level is widely accepted as the threshold for learners to begin to read authentic texts. Thus, it seemed appropriate to conjecture that the participants who had lower scores within the 3000 word level could be considered as
poor lexical knowledge learners for this study, thus eliminating the need for use of the 2000 word level test.

3.4.2 Reading Text

After careful examination of several articles available, the researcher selected the authentic reading passage *How to Cool a Planet* (see Appendix C) published in the *New York Times* on June 27, 2006. This authentic reading passage is 1574 words in length, which was much longer than necessary for the purposes of the present study. Due to practical constraints, such as the amount of time allowed to administer the reading passage, time allowed for the participants to read it, and the density of low-frequency words (level of text difficulty), the researcher shortened the passage to 523 words. However, the researcher decided not to select any target words for this study by manipulating the text. That is, no semantic adjustments, such as altering the vocabulary were made to minimize affecting the authenticity of the text.

As part of the selection of this text, the researcher examined the text’s readability through the Flesch-Kincaid Readability Test, which is designed to indicate comprehension difficulty in reading contemporary academic English. This test indicates reading ease score and grade level as well. The higher scores show the reading material is easier to read, and lower scores that the reading material is more difficult to read, with score ranges of 0-100. The analysis of the reading text selected for this study revealed that the grade level was 13, and the reading ease score was 33. These were deemed suitable scores for the purposes of the study, as they indicated that the text was not too
easy or difficult for the kinds of readers who participated in the study (that is, college students). More information about this is provided in the next paragraph.

With respect to this test, the reading ease score range of 0-30 is considered to be appropriate for college students. The results of other readability tests (Gunning Fox Index, Coleman Liau Index, ARI (Automated Readability Index), and SMOG (Simple Measure of Gobbledygook) formula also showed similar grade level scores for this reading text. Thus, this reading text appeared appropriate for this study and had a manageable level of difficulty for the participants, given that the participants were L2 learners and by referring to other studies previously mentioned as well. In addition, the researcher chose the reading text to meet the following criteria: first, the text would be interesting and appealing; second, the topic would not require prior or specialized knowledge; third, the topic would not entail either cultural bias or culture-bound concepts nor political concepts; lastly, the participants would encounter an appropriate number of unfamiliar words while reading, which fostered the participants’ strategic behavior.

For more detailed and precise analysis of the reading text, and to ensure an appropriate kind of reading experience, some field-specific terminology, such as geoengineering, sulfur, or carbon dioxide, was excluded inasmuch as the words did not have an influence on trigging strategic behaviors from the participants.

3.4.3 Text Presentation

With regard to how the text was presented to the participants, the researcher designed two different formats of the text with the same reading passage: computer-based and the print-based. The print-based text was printed out on plain paper for the
participants to read as they usually read from newspapers, journal articles, or handouts from class, with 1.5 line spacing in 12 point Times New Roman font. For the computer-based text, the researcher followed the same font, size, and spacing format as the print-based text, and made efforts to provide a similar reading environment to the print-based text to eliminate any confounding variables. Due to the length of the reading passage and the properties of the computer screen, for the computer-based text the participants were able to see the whole reading passage by scrolling down as in the case of other reading material on the computer screen.

As stated earlier, in terms of the terminology, the researcher provided definitions of the words, which were excerpted from *the Merriam-Webster Online Dictionary, the Cambridge Dictionaries Online, and the Longman Advanced American Dictionary* at the end of the text with asterisks (*) like a glossary both in the computer-based and the print-based formats. Given that the purpose of this study was to explore L2 learners’ strategic behaviors toward unknown words rather than either exploring learners’ reading comprehension or incidental vocabulary learning in relation to unknown words, the researcher believed that the format of the definition presentation needed to remain as simple as possible.

### 3.4.4 Checklist

As a way of recording the number of and types of the participants’ strategic behaviors, a checklist (see Appendix D) was developed. That is, the checklist was designed mainly for the quantitative data collection approach during DRTA reading sessions. The checklist categorized several types of strategies, such as ignoring,
inferencing, and dictionary consultation, presumably employed by the participants. Etc. was developed to identify other strategies not indicated in the checklist or any multiple strategy use. Under the category of etc., specific type of strategy use and frequency of each strategy was recorded. In addition to the frequency of and types of strategy use, reasons for employing specific strategy use that were provided by the participants were also recorded to support further analysis in the checklist. The researcher used the checklist while observing the participants’ reading sessions, both first and the second sessions.

3.4.5 Questionnaire for Demographic Information

A background information questionnaire (see Appendix B) was designed to collect participants’ demographic background information and information about their previous English learning experience in their home country. The questionnaire was composed of 11 questions. Questions 1 to 4 were developed to obtain demographic information about the participants. Information about academic background, such as academic major and degree being pursued, length of residency in North America, and duration of English study in their native countries was obtained from question 5 to 9. Question 10 was developed in order to know about the approximate number of hours of participants’ use of a computer. Question 11 was developed in order to know about participants’ self-perceived types of strategy use when encountering unknown words while reading an English text. At the end of the questionnaire, all participants were asked if they were willing to participate in the second phase of the data collection, the second DRTA reading session and an individual follow-up interview.
3.4.6 Delayed Retrospective Think-Aloud (DRTA) Process

In order to learn about the cognitive process of the participants’ employing specific strategies in certain situations, the DRTA process was administered during each reading session. The seven guided questions (see Appendix E) were developed for this process as a way of prompting the participants to verbalize their thoughts and mental process while demonstrating strategies. Thus, the questions mainly focused on uncovering grounds for their actual behaviors rather than the strategies they believed they adopted. For the participants to be better informed, the researcher demonstrated how to perform the process with the questions.

3.4.7 Semi-Structured Interview Questions

As a qualitative approach, a follow-up individual interview was conducted. The purpose of this interview was to obtain in-depth, unobservable, and additional information relevant to the learners’ awareness of, perceptions of, or attitudes toward their strategic behavior when encountering unknown words. More specifically, through the interview, the researcher could obtain “highly spontaneous, rich information that is idiosyncratic to individuals” (Oxford & Green, 1995, p. 167). To do so, the open-ended interview questions (see Appendix F) were developed based on the researcher’s notes and observations during the DRTA processes. That is, the questions looked at the participants’ perceived differences/similarities in confronting unknown words across the two environments; circumstance and reasons for using specific strategies for dealing with unknown words; and their experience in dealing with unknown words.
3.5 Data Collection Procedures

In this section, a pilot study, which was intended to verify and enhance reliability and validity of the data collection procedures, and the actual data collection procedures (first and second sessions) are described.

3.5.1 Pilot Study

The pilot study was conducted in February 2009 when the reading text was developed for this study. Given that the text was shortened, one undergraduate and two graduate native speakers of English were asked to verify its readability, along with its coherence in the first phase of the pilot study. They were also asked to select any words that they were not sure about and that they considered difficult for L2 learners. This process was carried out for the researcher to gain a sense of approximately how many words might be challenging for participants and elicit strategic behaviors in an actual study. Then, in the second phase of the pilot study, four L2 learners (two undergraduates and two graduates) were selected through the same procedures of data collection for the present study as representatives of the target population. After taking VLT, two of them were administered the DRTA session with the computer-based text, while the other two experienced the DRTA session with the print-based text. After the session, there was a follow-up individual interview session.

Based upon the pilot study, there were some revisions in terms of the data collection instruments. Above all, a couple of words in the reading text that the researcher adapted to easier or high frequency words were replaced with the original words (e.g., fringes, relegate, fallback, and etc.) from the authentic text. This was because of the fact
that those who had rich vocabulary knowledge identified fewer words that they did not know than the researcher expected. This seemed to result in triggering less strategic behavior. Also, questions for the DRTA process and interview were slightly revised for the participants to clearly understand the purpose of each question by reducing task demands and burdens from each procedure. In addition, time assigned for each procedure was changed. That is, the pilot study suggested all the procedures appeared to take less time than the researcher had planned.

3.5.2 Data Collection: 1st Session

Data were collected over one academic quarter between March and June 2009. As a means of recruiting participants for this study, the researcher sent a letter of recruitment (see Appendix G) through a listserve to international students’ organizations (Mainland Chinese, Japanese, Korean, and Taiwanese). Also, the letter was posted on bulletin boards, such as libraries and dormitories at school, with the permission of the Institutional Review Board (IRB) at the university. The letter described the purpose of the study, what the participants were supposed to do, the data collection procedures (Vocabulary Levels Test, Delayed Retrospective Think-Aloud Process with a reading passage in association with the researcher’s observation, interview, approximate time required for each process), and incentive for participation in the study.

In the first reading session, the researcher explained the purpose of the study, the data collection procedures, and what they were expected to do for this study. Then, the researcher administered the VLT to them either individually or with a small group of participants, based on the participants’ availability. Prior to the test, the participants read
and signed a consent form (see Appendix H) indicating their voluntary participation in this study. Then, the participants were asked if they were able to participate in the next procedures, the VLT and the first DRTA with a reading passage during the first meeting. Then, the participants were assigned about 20 minutes to take the VLT to assess their level of lexical knowledge. After the test, the participants filled out the background information questionnaire, which took about 10 minutes.

Upon completion of the VLT and background information questionnaire, the participants engaged in the first reading session individually for the DRTA. Although the duration of the DRTA session varied from participant to participant and with regard to text type (computer-based or print-based), this session generally ran approximately 30 to 40 minutes in duration. This process was recorded through an MP 3 player. The participants were briefly informed that when they started reading the passage, the recorder would be turned on. To control for effects that might arise from the order in which the treatments were administered (King & Minium, 2003), there was a 2-3 week interval between the two reading sessions. That is, since the same participants were included both in the first and second treatments, half of the participants read the print-based text in the first reading session and then read the computer-based text in the second reading session. Similarly, the other half of the participants read the computer-based text in their first reading session and then read the paper-based text. The order of which type of text, either computer-based or print-based, the participants would read was randomly selected and assigned. Depending on the type of text that the participants read, they were asked to bring the kind of dictionary that they usually used while studying.
During the individual reading session, the researcher tried to keep a relaxed and friendly relationship with the participants and provided a comfortable atmosphere to reduce anxiety and to optimize their performance of reading the text and verbalizing their thoughts. The researcher asked the participants to read as naturally as they usually did both in CBT and in PBT. In addition, for the print-based text they were also informed that they could use their own dictionary (either traditional print-based or electronic dictionary, and monolingual or bilingual) to look up unknown words if they wanted to. For the computer-based text, the participants were told that they could use any type of dictionary, including an online dictionary, according to their preference.

For the purposes of experimental design, the researcher prepared two copies of the paper-based text for each participant. The researcher presented the first text to the print-based text participants and asked them to read through the text quickly and to circle any words they did not know. Then, the participants were given the second copy of the text and started reading the text again. For the computer-based text readers, the researcher prepared both a print-based text, which was designed for the print-based text readers, and the computer-based text available on screen. The researcher presented the reading text printed on the plain paper to the computer-based text participants, asked the participants to read through the text quickly and to circle any words they did not know. Then, the participants started reading the computer-based text. While reading, as an attempt to apply the DRTA, the participants were asked to stop right after they finished reading a paragraph rather than a whole sentence to verbalize their process, behavior, or thoughts while coping with the unknown words.
During the reading session, the researcher tried to minimize interruption of the participants’ process by not asking any suggestive prompts or questions. The researcher carefully observed their process, paying attention to the words they indicated as unknown on the paper. While observing each individual, the researcher used the frequency checklist (see Appendix D), which includes specific types for strategies, such as ignoring, inferencing, dictionary consultation, and etc. and took detailed notes of their behavior. When the participants finished reading each paragraph, the researcher asked types of strategy use employed by them and kept a record of them. Then, the researcher also asked questions to generate detailed and thorough verbal reports. The researcher sometimes pointed out and asked for definitions of some words not identified by the participants, which the researcher assumed the participants might not know, to ascertain how well the participants could identify unknown words.

3.5.3 Data Collection: 2nd Session

After the first reading session, the researcher administered the second reading session for the DRTA, which was the same as the first reading session with the same thirty-four participants. There was a 2-3 week interval between the first and the second reading sessions to minimize treatment effect, and this process was also recorded via an MP3 player. This session generally ran approximately 30 to 40 minutes in duration. After the second reading session, the researcher had a follow-up semi-structured interview (see Appendix F) with each individual. The contents of this interview were based on the researcher’s notes and observations during the DRTA. The interview was intended to allow the researcher to obtain additional information about the participants’
overall perceptions of or experiences in their strategic behaviors toward unknown words, depending on different reading environments, by detecting detailed and delicate individual differences. The interviews lasted approximately 30-60 minutes. The interview session was also recorded for further analysis. Table 3.2 provides a summary of the data collection procedures.

<table>
<thead>
<tr>
<th>Session</th>
<th>Description of Session</th>
<th>N</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vocabulary Levels Test</td>
<td>34</td>
<td>20 minutes</td>
</tr>
<tr>
<td></td>
<td>Background Information</td>
<td>34</td>
<td>10 minutes</td>
</tr>
<tr>
<td></td>
<td>1st Delayed Retrospective Think-Aloud Process</td>
<td>34</td>
<td>30-40 minutes</td>
</tr>
<tr>
<td>2</td>
<td>2nd Delayed Retrospective Think-Aloud Process</td>
<td>34</td>
<td>30-40 minutes</td>
</tr>
<tr>
<td></td>
<td>Follow-up Individual Interview</td>
<td>34</td>
<td>30-60 minutes</td>
</tr>
</tbody>
</table>

Table 3.1: Summary of data collection procedures

3.6 Data Analysis

3.6.1 Quantitative analysis

As described earlier, both quantitative and qualitative sources of data were used for this study. For analysis of these sources, the researcher prepared log files for each participant, using a pseudonym for each of them. Quantitative analysis was carried out
for the VLT. Each individual vocabulary item was scored as 1 point for a correct answer and 0 for an incorrect answer; thus, the total possible score was 120. Each participant’s score was converted into a percentage. Statistical Package for the Social Sciences (SPSS) 15.0 for Window was used to analyze the quantitative data, specifically VLT. With the individual scores, frequency, percentages, mean, median, mode, and standard deviation were calculated to present the descriptive statistics for VLT.

Another type of quantitative analysis was used for the two sets of checklists of the DRTA processes in identifying and classifying the individual participants’ lexical processing strategies. In analyzing their strategies, the data was carefully examined several times for any observable strategies, and each vocabulary item was treated as a separate instance of lexical processing strategy use. For example, when a participant reported two types of strategies use with one word, occurring a couple times in the reading text (e.g., *curbing*), such as ignoring and inferencing for each occurrence, the participant’s behaviors were recorded both as ignoring and inferencing. When the participants used more than one strategic behavior in combination, such as inferencing and dictionary consultation, multiple coding was applied. As mentioned in Chapter 1, the main categories of strategy types for this study were operationalized and coded as ignoring, inferencing, dictionary consultation, inferencing+dictionary, or etc.

For the data of checklists, descriptive analysis was used in order to explain the proportions of all the participants’ strategic behaviors in coping with unknown words along with overall patterns of the strategy use. In addition, data were analyzed relative to three categories of the participants as well: level of vocabulary knowledge (high,
intermediate, and low), level of education (either undergraduate or graduate students), and country of origin (Mainland China, Japan, Korea, and Taiwan). Though they shared the same native language (L1) background, the Mainland Chinese and Taiwanese were treated as separate groups. Furthermore, despite their similar ethnicity—Chinese—their educational systems vary greatly, as does the role and importance of English in each country. Thus, their approaches to dictionary use and their relationship with different textual environments could also differ. Hence, for analytical purposes, it was considered best to regard them as separate groups of participants. The original plan for the study was to use L1 background as a factor to be explored, but in light of the fact that the Mainland Chinese and Taiwanese were both native Chinese speaking groups, and yet from different backgrounds in other regards, as just explained, it was deemed best to use country of origin instead.

3.6.2 Qualitative analysis

In contrast to the statistical analyses, the qualitative analysis was conducted for the individual follow-up interview data. The interviews were initially transcribed and then carefully examined for any observable patterns or relevant themes emerging from the participants after the data collection. That is, the participants’ perceptions of reading environment, effect of reading environment (computer versus print) on their strategy use, and use of specific strategies (such as ignoring, inferencing, or dictionary consultation) in dealing with unknown words were classified and identified mainly from the interview data. In classifying, identifying, and coding the participants’ interview data, the researcher also used the individual participants’ log files. The reliability of the coding
was established by the researcher and a second-coder, a colleague of the researcher. The results of the second-coder’s coding and the researcher’s coding were compared followed by a discussion for agreement and to address discrepancies. When there was any conflict between the two coders, agreement was reached by a panel of experts.

The individual participant’s log files were examined for detailed analysis. To do so, similar to the analysis of quantitative data, the analyses based on the log files were used to illustrate the participants’ perceptions of and overall strategic patterns in coping with unknown words as a whole group and three categories of the participants as well: level of vocabulary knowledge (rich versus poor), student status (undergraduate versus graduate students), and country of origin (Mainland China, Japan, Korea, and Taiwan). With regard to the level of vocabulary knowledge, interviews of 12 participants (6 from the advanced and 6 from the low groups) were analyzed and compared. The 6 participants were selected from each group in terms of who obtained the highest scores and the lowest scores.

After analyzing both the quantitative and qualitative data separately, the researcher looked at how the two data sets related to each other. In other words, the researcher compared or contrasted the two data sets for further investigation. More specifically, the participants’ perceptions of reading environment and of effect of reading environment in their strategy use were compared to observe similarities or differences based on the data obtained from the quantitative analysis and their actual approaches identified during the reading sessions. In so doing, the researcher believed that investigation of the research questions for this study was appropriately rigorous.
CHAPTER 4
RESULTS

4.1 INTRODUCTION

This chapter will describe the findings of the research relative to the purpose of this study and its research questions. The findings are presented in two parts: the first part reports the study’s quantitative results, and the second part focuses on the qualitative results. The first part starts with descriptions of the participants’ demographic information. Also, in that the first part looks at the quantitative findings, the emphasis is first on results related to the participants’ Vocabulary Levels Test (VLT) scores. Then, the participants’ strategy use will be illustrated followed by frequency of types of strategy use. In addition, the illustrations will be both about all participants as a whole group and grouped participants depending on their VLT scores, level of education (undergraduate and graduate students), and nationality. The second part of this chapter is derived from individual interview findings. This part examines the participants’ perceptions of or attitudes toward different reading environments, followed by their perceptions of strategic behaviors toward unknown words (ignoring, inferencing, dictionary consultation, and inferencing+dictionary). Similar to the first part, descriptions in this part will also be
both about the whole group and grouped participants depending on their level of vocabulary knowledge (rich versus poor), student status (undergraduate and graduate students), and country of origin.

4.2 Part One: Quantitative Results

4.2.1 Description of the study’s participants

The participants in this study were 34 international students (26 females and 8 males) who were enrolled either as undergraduates (N=14) or graduates (N=20) at a Midwest university in the United States. They were from Mainland China (N=10), Japan (N=2), Korea (N=10), and Taiwan (N=12). There were 20 participants whose ages ranged from 20-25; 11 participants whose ages ranged from 26-30; 2 participants whose ages ranged from 31-35; and 1 participant whose age was 36-40. Table 4.1 illustrates further demographic information about the participants in the present study.

<table>
<thead>
<tr>
<th>Residency in the US (months)</th>
<th>Range</th>
<th>3-72</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>26</td>
</tr>
<tr>
<td>Duration of English study in home country (years)</td>
<td>Range</td>
<td>7-18</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>12</td>
</tr>
</tbody>
</table>

*Table 4.1: Demographic information of the participants*
Also, the participants’ reports revealed a wide range of hours of computer use per week. The average use of computer was 28 hours per week. Table 4.2 shows detailed information about their use of a computer.

<table>
<thead>
<tr>
<th>Hours</th>
<th>5-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26-30</th>
<th>31-35</th>
<th>36-40</th>
<th>41-45</th>
<th>46-50</th>
<th>51+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Participants</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

N=34

Table 4.2: Participants’ use of computer per week

4.2.2 Vocabulary Levels Test (VLT) Scores

As an important starting point for this study, it was necessary to measure the participants’ vocabulary knowledge. The scores for the Vocabulary Levels Test (VLT) demonstrate that there was wide variance among the thirty-four participants. The descriptive statistics, as can be seen from Table 4.3, show that the highest score was 112 (93%) on a test where the maximum score possible was 120, and the lowest score was 59 (49%). As stated in the previous chapter (Chapter 3), all the scores were converted into percentages for a better understanding of score variances, and they are indicated in parentheses. The mean of the VLT scores was 90 (75%) out of 120, with a standard deviation of 13.3. The median was 89 (74%), indicating that half of the participants obtained a score below 89, and the other half of the participants obtained a score above
89. The statistics also reveal that the mode was 83 (69%), that is, 83 was the score obtained most frequently among the participants.

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>STD</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>59.00</td>
<td>112.00</td>
<td>90.1176</td>
<td>13.30018</td>
<td>-.198</td>
</tr>
</tbody>
</table>

N = 34

**Table 4.3**: Descriptive statistics of participants’ VLT score

In addition, the participants’ scores demonstrate a moderate skewness (-.198), which indicates that overall the VLT was neither too easy nor too difficult for the participants. This was also verified by the slight score differences between the mean (90, or 75%) and median (89, or 74%). Thus, the VLT produced a useful distribution of scores. The results in Table 4.3 are supplemented by those in Table 4.4, which displays the distribution of individual VLT scores.
Table 4.4: Distribution of participants’ VLT scores

<table>
<thead>
<tr>
<th>Scores</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>59.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>68.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>70.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>73.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>75.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>77.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>82.00</td>
<td>2</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>83.00</td>
<td>4</td>
<td>11.8</td>
<td>11.8</td>
</tr>
<tr>
<td></td>
<td>85.00</td>
<td>2</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>87.00</td>
<td>2</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>89.00</td>
<td>3</td>
<td>8.8</td>
<td>8.8</td>
</tr>
<tr>
<td></td>
<td>90.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>91.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>93.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>98.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>102.00</td>
<td>2</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>103.00</td>
<td>3</td>
<td>8.8</td>
<td>8.8</td>
</tr>
<tr>
<td></td>
<td>105.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>107.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>108.00</td>
<td>2</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>110.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>112.00</td>
<td>1</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Based on the participants’ VLT scores, the participants were then divided into three groups: advanced, intermediate, and low. As shown in Table 4.5, the descriptive
statistics of the advanced group of twelve participants show that scores for the group ranged from 112 (93%) to 98 (82%) of the maximum possible score of 120. The mean of this group was 105 (88%), with a standard deviation of 3.99. The median was 104 (87%), and the mode was 103 (86%).

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>STD</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>98.00</td>
<td>112.00</td>
<td>105.0833</td>
<td>3.98769</td>
<td>.112</td>
</tr>
</tbody>
</table>

N = 12

**Table 4.5**: Descriptive statistics of VLT score (Advanced Group)

Furthermore, the participants’ scores demonstrate a moderate skewness (.112), which indicates that the level of difficulty of the VLT appeared to be reasonable for this group relative to Geroge and Mallery’s (2005) statement that a vale of skewness between +/- 2.0 is acceptable in social behavior research. In addition, given the score differences between the mean (105, or 88%) and median (104, or 87%), the score distribution for this group appears to cluster around the mean. That is, the participants’ scores in this group seem to be evenly distributed around the mean.

Meanwhile, the intermediate group consisted of ten participants. Table 4.6 illustrates the descriptive statistics for the VLT scores for this group. The scores ranged from 93 (78%) to 85 (71%) out of 120. The mean of this group was 89 (74%), with a
standard deviation of 2.55. The median was 89 (74%), and the mode was also 89 (74%) of 120.

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>STD</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>85.00</td>
<td>93.00</td>
<td>88.500</td>
<td>2.54951</td>
<td>.151</td>
</tr>
</tbody>
</table>

N = 10
Table 4.6: Descriptive statistics of VLT score (Intermediate Group)

Again, the participants’ scores show a moderate skewness (.151), which indicates that the level of difficulty of the VLT appears to have been appropriate for this group. Given that the mean, median, and mode were the same, 89 (74%), it implies a normal distribution within this group.

Lastly, the descriptive statistics for the low group, which was comprised of twelve participants, show scores ranging from 83 (70%) to 59 (49%), as shown in Table 4.7. The mean for this group was 76.5 (64%), with a standard deviation of 7.78. The median was 79.5 (66%), and the mode was 83 (69%).

In addition, the participants’ scores indicate a heavier skewness (-1.129), which shows that within this group many of the participants obtained higher scores in the VLT. However, considering George and Mallory’s (2005) statement as stated earlier, which suggests that the value of skewness between +/- 2.0 is acceptable in social behavior research, the skewness of this group is tolerable. In the mean time, as indicated from the
standard deviation, there is a wide range of scores within this group, which is due to two or three extreme low scores. It also indicates a negative skewness, since the median score (79.5, or 66%) of the participants in this group was higher than the mean score (76.5, or 64%) of the participants. In other words, some of the participants’ vocabulary knowledge might have made the VLT very challenging for them to generate score variances within this group.

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>STD</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>59.00</td>
<td>83.00</td>
<td>76.50</td>
<td>7.77525</td>
<td>-1.129</td>
</tr>
</tbody>
</table>

\[N = 12\]

Table 4.7: Descriptive statistics of VLT score (Low Group)

4.2.3 Strategy Use of All Participants

4.2.3.1 Frequency of Strategy Use

Given the purpose of this study, which was to compare participants’ approaches to strategy use in two environments, Computer-Based Texts (CBT) and Paper-Based Texts (PBT), it was important to examine the frequency of their use of different strategies for looking up unknown vocabulary items. As a first step, the frequency of strategy use employed by all the participants will be described in tandem with a comparison of the CBT and PBT environments. Next, an explanation of the three groups’ (advanced, intermediate, and low group) frequency of strategy use will be provided, and the
frequency of strategy use of both undergraduate and graduate students will also be examined. Lastly, a description based on the participants’ nationality (Mainland Chinese, Korean, and Taiwanese) will be presented. Also, each section will include a description of frequency of strategy use in relation to types of strategy use, such as ignoring, inferencing, and dictionary consultation.

Figure 4.1 examines the number of times the participants used a look-up strategy in each of the two environments explored in this study. These were compiled via a frequency checklist designed to indicate which strategies the participants used as well as how often they used them.

Figure 4.1: Total number of strategy uses among participants
The analysis of the frequency checklist that the researcher used while observing individual participant’s strategy use revealed that there was a slight difference between the two different reading environments, CBT and PBT. Of the total 745 instances of strategy use, there was a relatively equal distribution across the two environments, with 386 instances of strategy use in CBT and 359 in PBT, as shown in Figure 4.1. In other words, the participants in CBT demonstrated 52% of strategy use in total, and the remaining 48% of strategy use occurred in PBT, as shown in Figure 4.2. Here it needs to be remembered that all of the participants were exposed both to CBT and PBT, with a 2-3 week interval between these exposures. Also, half of the participants were exposed to CBT first followed by PBT and vice versa for the remaining half of the participants. Thus, any differences in the participants’ behavior could be attributed to factors other than amount and order of exposures, since amount and order of exposures was equal across the two environments. The important point emerging from these results is that there was not a substantial difference in the amount of instances of strategy use in the two environments, with CBT showing only a slightly higher number of instances.
4.2.3.2 Types of Strategy Use

In addition to the overall amount of all participants’ strategy use, the frequency of strategy use in relation to strategy types, such as ignoring, inferencing, or dictionary consultation, was also analyzed. After the analysis, a combination of inferencing + dictionary, or multiple strategy use, was added to the type of strategy use, inasmuch as many participants indicated that they employed both strategies: they used inferencing as their first attempt to deal with the meaning of unknown words and used a dictionary (looking up in the dictionary) as their second attempt to unravel the meaning of new words. Thus, the researcher identified this multiple strategy use as different from the various single strategy options: ignoring, inferencing, and dictionary consultation. Furthermore, the researcher also categorized etc. according to some instances as another type of strategy employed. The instances, although they appeared to be obscure, were derived from some participants’ explanation that they did not pay much attention to
figuring out unknown words (similar to ignoring) because they could guess the meaning of the unknown words.

In CBT, as indicated in Table 4.8, of the types of strategies used, the most frequently employed strategy by the participants was dictionary, followed by inferencing. More specifically, dictionary was employed more than twice as much as inferencing. Then, inferencing +dictionary were used more frequently than ignoring. That is, of 386 instances of strategy use in total, the participants employed dictionary 211 times, inferencing 91 times, inferencing+dictionary 43 times, and ignoring 36 times. The participants employed dictionary a little more than a half of the total frequency of strategy use (55%) and more than twice as much as inferencing, which ranked as the second most employed strategy by all the participants. There was no considerable difference between the use of inferencing+dictionary and ignoring. The strong preference for dictionary use in the computer-based environment could be explained by easy and fast access to the online dictionary, regardless of type of dictionary used (bilingual or monolingual), through the Internet.

<table>
<thead>
<tr>
<th>Text</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>36</td>
<td>91</td>
<td>211</td>
<td>43</td>
<td>5</td>
<td>386</td>
</tr>
<tr>
<td></td>
<td>(9%)</td>
<td>(24%)</td>
<td>(55%)</td>
<td>(11%)</td>
<td>(1%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>38</td>
<td>112</td>
<td>168</td>
<td>37</td>
<td>4</td>
<td>359</td>
</tr>
<tr>
<td></td>
<td>(11%)</td>
<td>(31%)</td>
<td>(47%)</td>
<td>(10%)</td>
<td>(1%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.8: Participants’ use of strategy type
The participants in PBT by and large showed similar patterns to CBT. That is, dictionary was the most frequently employed strategy by the participants (168 instances, or 47%), and inferencing was the second most frequently used strategy (112 instances, representing 31%). Then, ignoring was used, followed by inferencing+dictionary. Compared to CBT, there are two interesting and important points to be noted. First, although dictionary was the most frequently employed strategy by the participants both in CBT and PBT, the participants demonstrated more frequent use of dictionary in CBT than in PBT (55% to 47%). Also interesting is the role of inferencing. At 31% in PBT, it was used more often than in CBT (24%), and there was a smaller difference between its use and dictionary in PBT (16%) compared to CBT (31%). These results suggest that unlike in CBT, the participants appeared to be less likely to use a dictionary mainly due to inconvenient access to a dictionary while in PBT or their reluctance to make any effort to locate a dictionary, which might then result in more frequent use of inferencing in PBT.

Meanwhile, there was no meaningful difference with respect to other strategies: the participants used ignoring slightly more often than inferencing+dictionary in PBT (11% to 10%), whereas they employed inferencing+dictionary slightly more often than ignoring in CBT (11% to 9%). The comparisons between these uses are shown in Figure 4.3 in terms of amount of use. Clearly, dictionary and inferencing were the major strategies of choice in both environments. What is interesting here is that they represent such opposite forms of locating word meaning: direct retrieval of information from a dictionary compared to guessing from context for inferencing. These two strategies also
might result in different levels of reading comprehension and enhancing learners’ vocabulary knowledge.

4.2.4 Strategy Use of Groups of Participants

In this subsection we turn to a comparison of the three groups as defined by level of vocabulary knowledge.

4.2.4.1 Frequency of Strategy Use

Figure 4.4 provides a look at how the groups compared in terms of the number of times they used different strategies.

Figure 4.3: Number of strategy uses by participants
The analysis of the frequency of strategy use for the three groups divided by their VLT scores indicates that, although the difference was not considerable, participants in two groups (advanced and low) employed strategies more frequently in CBT than in PBT, as shown in Figure 4.4. On the other hand, participants in the intermediate group used strategies in CBT as much as in PBT. Figure 4.5 offers some additional perspective on these results by showing, percentagewise, the amount of strategy use by each group in the two environments combined.
What is most notable here, perhaps, is the performance of the low group compared to the other two groups. The total percentage frequency of strategy use (48%) for the low group reached close to half for that of all the three groups combined, with the advanced group second at 28.5% and the intermediate group last at 23.5%. Table 4.9 offers an interesting breakdown of these figures by looking at the average number of strategy uses among the three groups in each environment. Specifically, taking into consideration the number of participants in each group (12 participants in the advanced group, 10 participants in the intermediate group, and 12 participants in the low group), the average frequency of strategy use for the advanced group was 9.8 in CBT and 7.8 for PBT. For the intermediate group, the average was 8.7 for CBT and 8.8 for PBT. On the other hand, on average, the low group used strategies 15.1 times in CBT and 14.8 times in PBT. In CBT, the intermediate group employed strategies least, whereas, in PBT, the advanced group used strategies least.
<table>
<thead>
<tr>
<th>Level Text</th>
<th>Advanced</th>
<th>Intermediate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>9.8</td>
<td>8.7</td>
<td>15.1</td>
</tr>
<tr>
<td>Paper</td>
<td>7.8</td>
<td>8.8</td>
<td>14.8</td>
</tr>
</tbody>
</table>

Table 4.9: Each group’s mean of frequency of strategy use

That the low group employed strategies more often than the other groups may not seem surprising given that, being the low group, they would presumably encounter more new words and need more assistance in trying to understand them than the intermediate and advanced groups. Still, it is interesting to observe just how much more they employed strategies than the other two groups. The relative similarity between the advanced and intermediate groups may not seem surprising since they were closer in vocabulary knowledge to begin with.

4.2.4.2 Types of Strategy Use Within the Advanced Group

As described above, the twelve participants in the advanced group employed more strategies in CBT than PBT: 118 times in CBT compared to 94 times in PBT (shown in Table 4.10). That is, 56% of the total frequency of strategy use occurred in CBT and 44% in PBT (see Figure 4.6). Thus, the difference in relation to the frequency of strategy use between CBT and PBT appears to be substantial.
Figure 4.6: Percentage of strategy use of Advanced group in CBT and PBT

Differences also occurred in the types of strategies employed by this group. As illustrated in Table 4.10, the most frequently employed strategy both in CBT and PBT was looking up words in a dictionary; however, there was a considerable difference in the proportions of the use of this strategy in each reading environment. For example, in CBT the participants used a dictionary 66 times, or 56% of the total strategy use, compared to 39 times, or 41.5% of the total, in PBT. The next frequently employed strategy use in CBT was inference+dictionary. The participants employed the strategy 27 times, showing about 23% of the total strategy use. The same strategy was used only 12 times (12.8%) in PBT. On the other hand, participants displayed a much stronger tendency toward the use of inferencing in PBT, where it was used 38 times (40.4% of the total), compared to 22 times, or just 18.6% of the total, in CBT.
Figure 4.7 offers further perspective on the strategy use in these two environments by directly comparing the use of strategies across the environments. What stands out here is the different patterns of distribution. For instance, 82% of strategy use in PBT occurred within just two strategies: dictionary and inferencing. On the other hand, in CBT, there was a wider spread involving three strategies: dictionary (56%), inferencing + dictionary (23%), and inferencing (19%). Thus, while dictionary use dominated at 56%, the participants seemed to show more variability in their strategy use in the computer-based environment.

<table>
<thead>
<tr>
<th>Text</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>3</td>
<td>22</td>
<td>66</td>
<td>27</td>
<td>0</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td>(2.5%)</td>
<td>(18.6%)</td>
<td>(56%)</td>
<td>(22.9%)</td>
<td>(0%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>3</td>
<td>38</td>
<td>39</td>
<td>12</td>
<td>2</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>(3.2%)</td>
<td>(40.4%)</td>
<td>(41.5%)</td>
<td>(12.8%)</td>
<td>(2.1%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.10: Advanced group’s strategy use
4.2.4.3 Types of Strategy Use Within the Intermediate Group

Overall, there was much more consistency within this group across the two textual environments compared to the advanced group. This is first seen in Figure 4.8, where the intermediate group demonstrated almost the same amount of strategy use both in CBT and PBT: 50.3% in CBT and 49.7% in PBT. More specifically, the ten participants in this group employed strategies 87 times in CBT and 88 in PBT. Thus, the differences within this group were almost negligible. However, it is also worth noting the drop-off in overall strategy use compared to the advanced group with respect to CBT: 118 uses by the advanced group compared to 87 by the intermediate group. On the other hand, the amount of uses was similar for PBT: 94 times for the advanced group and 88 for the intermediate group.

**Figure 4.7:** Advanced group’s percentage of strategy use
Consistency within the intermediate group is also revealed in Table 4.11 with regard to the frequency of types of strategy use. Here we see that, with the small exception of inferencing+dictionary, there were basically the same preferences for strategy use in each environment, with differences of just 2 uses (2% to 3%) among all of the other options employed. At 16% (14 uses) compared to 8% (7 uses), there was a slightly stronger preference for inferencing+dictionary. As seen earlier, there was more variation among the strategy types within the advanced group.
Figure 4.9 shows that, as with the advanced group, dictionary use dominated in both the CBT and PBT environments at 51% (CBT) and 48% (PBT). Inferencing (31% for CBT and 28% for PBT) was a somewhat distant second, though it was still a fairly popular choice.

![Figure 4.9: Intermediate group’s percentage of strategy use](image_url)

Table 4.11: Intermediate group’s strategy use

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>9 (10%)</td>
<td>27 (31%)</td>
<td>44 (51%)</td>
<td>7 (8%)</td>
<td>0</td>
<td>87</td>
</tr>
<tr>
<td>Paper</td>
<td>7 (8%)</td>
<td>25 (28%)</td>
<td>42 (48%)</td>
<td>14 (16%)</td>
<td>0</td>
<td>88</td>
</tr>
</tbody>
</table>

Table 4.11: Intermediate group’s strategy use

Figure 4.9 shows that, as with the advanced group, dictionary use dominated in both the CBT and PBT environments at 51% (CBT) and 48% (PBT). Inferencing (31% for CBT and 28% for PBT) was a somewhat distant second, though it was still a fairly popular choice.

![Figure 4.9: Intermediate group’s percentage of strategy use](image_url)

Table 4.11: Intermediate group’s strategy use

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>9 (10%)</td>
<td>27 (31%)</td>
<td>44 (51%)</td>
<td>7 (8%)</td>
<td>0</td>
<td>87</td>
</tr>
<tr>
<td>Paper</td>
<td>7 (8%)</td>
<td>25 (28%)</td>
<td>42 (48%)</td>
<td>14 (16%)</td>
<td>0</td>
<td>88</td>
</tr>
</tbody>
</table>

Table 4.11: Intermediate group’s strategy use

Figure 4.9 shows that, as with the advanced group, dictionary use dominated in both the CBT and PBT environments at 51% (CBT) and 48% (PBT). Inferencing (31% for CBT and 28% for PBT) was a somewhat distant second, though it was still a fairly popular choice.

![Figure 4.9: Intermediate group’s percentage of strategy use](image_url)
4.2.4.4 Types of Strategy Use Within the Low Group

The low group was much like the intermediate group with respect to the overall distribution of strategy use across the two environments, as Figure 4.10 indicates. At 49% in PBT and 51% in CBT, there was no meaningful difference within the 12 participants in this group.

![Figure 4.10: Percentage of strategy use of Low group in CBT and PBT](image)

In spite of the fact that there was no considerable difference with regard to the overall proportions of strategy use between CBT and PBT, there was some variance in relation to the frequency of strategy use compared to the other groups—advanced and intermediate (see Table 4.12). Similar to the other groups, in CBT, dictionary was the most frequently used strategy: 101 times in CBT, or 56% of the total strategy use. It was
87 times, or 49%, in PBT. Inferencing also continued to be fairly popular: 49 uses (28%) in PBT and 42 uses (23%) in CBT. Where the variation occurred was in the relative popularity of ignoring, with 28 uses (16%) in PBT and 24 uses (13%) in CBT. In other words, ignoring was used much more often by the low group compared to the other two groups. Also worth noting in this table is a point made earlier: that the overall number of uses was much higher than for the other groups, with the total number of uses in CBT (181) almost half of the total for all three groups combined (386). The same was true for PBT, with the total of 177 uses almost half the combined total (359) for the three groups, as portrayed earlier in Figure 4.4. In short, the low group used strategies of one kind or another far more often than the other two groups. This was also seen in Table 4.9, where the average number of uses per participant (15.1 for CBT and 14.8 for PBT) was considerably higher than for the other two groups.

<table>
<thead>
<tr>
<th>Strategy Text</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>24</td>
<td>42</td>
<td>101</td>
<td>9</td>
<td>5</td>
<td>181</td>
</tr>
<tr>
<td></td>
<td>(13%)</td>
<td>(23%)</td>
<td>(56%)</td>
<td>(5%)</td>
<td>(3%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>28</td>
<td>49</td>
<td>87</td>
<td>11</td>
<td>2</td>
<td>177</td>
</tr>
<tr>
<td></td>
<td>(16%)</td>
<td>(28%)</td>
<td>(49%)</td>
<td>(6%)</td>
<td>(1%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.12**: Low group’s strategy use
Figure 4.11 also shows the overall domination of dictionary use within this group, and its dominance for each environment, at 56% (CBT) and 49% (PBT), respectively. Interferencing was used approximately half as much as dictionary, and ignoring about half as much as interferencing. However, where dictionary use was more popular in CBT than in PBT, there was, by a small margin, a preference for interferencing and ignoring in PBT than in CBT.

![Chart showing frequency of strategy use](image)

**Figure 4.11**: Low group’s percentage of strategy use

### 4.2.4.5 Summary

In sum, the data indicated that within each group, there was not a substantial difference in relation to the frequency of strategy use between CBT and PBT (see Figure 4.12). In particular, except for the advanced group, the other two groups (intermediate...
and low) demonstrated almost the same frequency of strategy use both in CBT and PBT. The advanced group showed a little more strategy use, 12% difference of the total strategy use, in CBT. Interestingly, and as noted earlier, it was the low group that employed strategies most frequently. As discussed earlier, this was perhaps not surprising since, as the low group, they could be expected to know less vocabulary and thus seek more help in defining unknown words or ignoring those that seemed difficult to understand. Also interesting is the fact that the intermediate group used strategies less frequently than both the low and advanced groups. This might be due to the fact that their VLT scores were evenly distributed and clustered around the mean without extreme scores, which probably implies less individual variance among them. With regard to the types of strategy use, although there was some variance within groups, dictionary was the predominantly employed strategy both in CBT and PBT among the three groups, with inferencing second, while the low group showed more use of ignoring than the other two groups. In terms of the two environments, CBT and PBT, there was only very minor variance in the total amount of strategy uses between them and with respect to the employment of specific strategies. In other words, textual environment (computer-based versus paper-based) did not appear to have much impact on participants’ use of strategies.
4.2.5 Strategy Use of Undergraduate and Graduate Students

4.2.5.1 Frequency of Strategy Use

Although a comparison of these two groups might not be precise due to the different number of participants (fourteen undergraduate students and twenty graduate students), the results provide a helpful sense of the extent of their strategy use. As illustrated in Figure 4.13, undergraduate students used strategies 125 times in CBT and 138 times in PBT, while graduate students employed strategies 261 times in CBT and 221 times in PBT. In terms of a comparison between the groups, it is interesting to note the difference in emphasis between them on use within the two environments, with undergraduate students having employed strategies slightly more frequently in PBT (138
times) than CBT (125 times), while graduate students displayed the opposite tendency, having employed strategies more often in CBT (261 times) than PBT (221 times).

![Figure 4.13: Number of strategy uses of undergraduate and graduate students](image)

Figure 4.13: Number of strategy uses of undergraduate and graduate students

Another way of viewing these differences is to look at the average number of uses among the two groups. As shown in Table 4.13, undergraduate students employed strategies less on average both in CBT and PBT than graduate students: 8.9 times in CBT and 9.9 times in PBT. By contrast, graduate students on average used strategies an average of 13 times in CBT and 11 times in PBT. Considering that fewer undergraduates participated in this study than did graduate students, these data might not be reliable;
however, it is still of value to note that the gap in average strategy use between the two
groups was greater in CBT (4.1) than in PBT (1.1).

<table>
<thead>
<tr>
<th>Level Text</th>
<th>Undergraduate</th>
<th>Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>8.9</td>
<td>13</td>
</tr>
<tr>
<td>Paper</td>
<td>9.9</td>
<td>11</td>
</tr>
</tbody>
</table>

**Table 4.13**: Each group’s mean of strategy use

4.2.5.2 Types of Strategy Use of Undergraduate Students

As described above, fourteen undergraduate students used 125 strategies in CBT and 138 strategies in PBT. That is, about 53% of the total strategy use was employed in PBT, and about 48% of the total strategies used occurred in CBT (see Figure 4.13).
Figure 4.14: Percentage of strategy use of undergraduate students in CBT and PBT

Detailed analysis of types of strategy use in this group revealed several important points to be addressed (see Table 4.14). Above all, as was often the case, dictionary was predominantly used in CBT (67 times, or 53.6%), with inferencing a reasonably strong second (36 times, or 28.8%), followed by ignoring, which was used only slightly more often than inferencing+dictionary.
<table>
<thead>
<tr>
<th>Strategy</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>11</td>
<td>36</td>
<td>67</td>
<td>10</td>
<td>1</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>(8.8%)</td>
<td>(28.8%)</td>
<td>(53.6%)</td>
<td>(8%)</td>
<td>(0.8%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>16</td>
<td>54</td>
<td>45</td>
<td>20</td>
<td>3</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>(12%)</td>
<td>(39%)</td>
<td>(33%)</td>
<td>(14%)</td>
<td>(2%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.14: Undergraduate students’ strategy use**

An interesting shift in use took place in PBT, with dictionary (45 times, or 33%) not the most frequently employed strategy. Inferencing, at 54 times (39%), was the most frequently used strategy by the participants, and there was much greater use of inferencing+dictionary (14% compared to 8% in CBT) and ignoring (12% compared to 8.8% in CBT). Thus, the undergraduates reacted somewhat differently in the paper-based environment than they did while using a computer.
4.2.5.3 Types of Strategy Use of Graduate Students

The twenty graduate students employed strategies 261 times in CBT and 221 times in PBT. In other words, about 46% of the total strategy use was employed in PBT, and about 54% of the total strategy use was employed in CBT (see Figure 4.16).
Figure 4.16: Percentage of strategy use of graduate students in CBT and PBT

As Table 4.15 shows, dictionary use was dominant among graduate students in both environments, at 55.7% (PBT) and 55.2% (CBT), respectively, and inferencing a distant second at 26.2% (PBT) and 21.1% (CBT), respectively.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>25</td>
<td>55</td>
<td>144</td>
<td>33</td>
<td>4</td>
<td>261</td>
</tr>
<tr>
<td></td>
<td>(9.6%)</td>
<td>(21.1%)</td>
<td>(55.2%)</td>
<td>(12.6%)</td>
<td>(1.5%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>22</td>
<td>58</td>
<td>123</td>
<td>17</td>
<td>1</td>
<td>221</td>
</tr>
<tr>
<td></td>
<td>(10%)</td>
<td>(26.2%)</td>
<td>(55.7%)</td>
<td>(7.7%)</td>
<td>(0.4%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.15: Graduate students’ strategy use
Figure 4.17 shows that there was not much variation within this group across different strategy types in the two environments, with dictionary (56% versus 55%) and ignoring (10% versus 10%) virtually the same and small differences between inferencing (26% PBT versus 21% CBT) and inferencing+dictionary (13% for CBT and 8% for PBT). In general, the graduate students showed much more consistency across the two environments than did the undergraduate students.

![Graph showing strategy use across CBT and PBT](image)

**Figure 4.17:** Graduate students’ percentage of strategy use in CBT and PBT

4.2.5.4 Summary

To sum up, and as shown in Figure 4.18, although there were not enough undergraduate students to make a genuine comparison with graduate students,
interestingly, undergraduate students showed slightly more strategy use in PBT than in
CBT. Graduate students, on the other hand, demonstrated more strategy use in CBT than
in PBT. However, perhaps surprisingly, graduate students employed strategies far more
often than undergraduate students both in CBT and PBT, while, as noted earlier,
undergraduates displayed more variation in their strategy use within the two reading
environments. Thus, whether students were undergraduates or graduates appeared to have
some impact on their use of strategies in the two reading environments.

**Figure 4.18**: Undergraduate and graduate students’ percentage of strategy use
4.2.6 Strategy Use Relative to Country of Origin

4.2.6.1 Frequency of Strategy Use

Figure 4.19 depicts a comparison of how the three groups of country of origin (10 Mainland Chinese, 10 Koreans, and 12 Taiwanese)\(^9\) demonstrated strategy use in terms of frequency both in CBT and in PBT. For the purposes of this analysis, the Mainland Chinese and Taiwanese were treated as separate groups. Though they share the same ethnicity—Chinese—their educational systems vary greatly, as does the role and importance of English in each country. Thus, their approaches to dictionary use and their relationship with different textual environments could also differ. Hence, for analytical purposes, it was considered best to regard them as separate groups of participants. The analysis of the three groups reveals that both the Mainland Chinese and Taiwanese students employed strategies more frequently in CBT than in PBT. Interestingly, on the other hand, Korean students employed strategies more frequently in PBT than in CBT, although the difference was not striking. This difference may seem surprising, given that overall there was a much stronger tendency for the participants to employ more strategies in CBT than in PBT (as shown earlier in this chapter), and that the Mainland Chinese, Taiwanese, and Korean shared the same non-European language backgrounds and all came from EFL (English as a foreign language) rather than ESL (English as a second language) settings. These results suggest that there was some other factor or set of factors at work in their approaches to strategy use.

\(^9\) Japanese students’ data were not analyzed because there were only two Japanese students, which does not seem to be enough participants to compare in this section.
Table 4.16 provides a further analysis of these results by looking at the average number of strategy uses among the three groups in each environment. Specifically, the average frequency of strategy use for Mainland Chinese students was 11.7 in CBT and 9.7 for PBT. For Taiwanese students, the average was 13.9 in CBT and 12.3 in PBT. On the other hand, Korean students used strategies 8.7 times in CBT and 10.3 for PBT on average. In these results it is difficult to see any patterns other than the Mainland Chinese and Taiwanese both using strategies more frequently in CBT than in PBT. An interesting point here is that there is a wider variance across the three groups in terms of the frequency of strategy use on average in CBT (5.2) than in PBT (2.6).
### Table 4.16: Each group’s mean of strategy use (Country of Origin)

<table>
<thead>
<tr>
<th>Origin</th>
<th>Chinese</th>
<th>Korean</th>
<th>Taiwanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>11.7</td>
<td>8.7</td>
<td>13.9</td>
</tr>
<tr>
<td>Paper</td>
<td>9.7</td>
<td>10.3</td>
<td>12.3</td>
</tr>
</tbody>
</table>

4.2.6.2 Types of Strategy Use Among the Mainland Chinese Students

As stated above, the ten Mainland Chinese students employed more strategies in CBT than in PBT, as shown in Table 4.17: 117 times in CBT compared to 97 times in PBT. That is, 55% of the total frequency of strategy use occurred in CBT and 45% in PBT (see Figure 4.20). Thus, the difference with respect to the frequency of strategy use between CBT and PBT seems to be fairly considerable.

![Pie chart showing 55% in CBT and 45% in PBT](Figure 4.20: Percentage of strategy use of Mainland Chinese students in CBT and PBT)
The differences were also noticed in the types of strategy use employed by the Mainland Chinese students. As illustrated in Table 4.17, the most frequently employed strategy in CBT was dictionary (56 times, or 47.9%), with inferencing a distant second (34 times, or 29.1%), followed by ignoring (17 times, or 14.5%), which was used about twice more often than inferencing+dictionary (8 times, or 6.8%). An interesting point here is that the Mainland Chinese students employed ignoring twice as often as inferencing+dictionary (17 times, or 14.5%, compared to 8 times, or 6.8%) in CBT. On the whole, the results suggest that the Mainland Chinese students were somewhat dictionary oriented in their strategy use within the computer-based environment.

<table>
<thead>
<tr>
<th>Strategy Text</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>17</td>
<td>34</td>
<td>56</td>
<td>8</td>
<td>2</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>(14.5%)</td>
<td>(29.1%)</td>
<td>(47.9%)</td>
<td>(6.8%)</td>
<td>(1.7%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>17</td>
<td>37</td>
<td>32</td>
<td>11</td>
<td>0</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>(18%)</td>
<td>(38%)</td>
<td>(33%)</td>
<td>(11%)</td>
<td>(0%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.17: Mainland Chinese students’ strategy use

A noticeable shift in use occurred in PBT among this group: surprisingly, dictionary (32 times, or 33%) was not the most frequently employed strategy. Inferencing, at 37 times (38%), was the most frequently used strategy by the Mainland Chinese students. Also, there was greater use of ignoring (18% compared to 14.5% in CBT) and
inferencing+dictionary (11% compared to 6.8% in CBT). These results may have been caused by the additional effort required in using a dictionary in PBT. In CBT, a dictionary could be accessed easily while online, while there was more ‘looking up’ effort necessary in PBT. As such, inferencing and ignoring could well have had more appeal in PBT than in CBT.

Figure 4.21 shows a further perspective on the strategy use in the two environments among the Mainland Chinese students. What is noticeable here is a pattern of distribution. For example, although there is some difference in terms of the proportions of strategy uses in each environment, the Mainland Chinese students appeared to employ various strategies, including dictionary, inferencing, and ignoring, across the two environments.

![Figure 4.21: Percentage of strategy use (Mainland Chinese)](image-url)

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4.2.6.3 Types of Strategy Use Among the Korean Students

As described earlier, ten Korean students employed more strategies in PBT than in CBT: 103 times in PBT compared to 87 times in CBT (shown in Table 4.18). That is, 54% of the total strategy use occurred in PBT and 46% in CBT (see Figure 4.22). Thus, the difference in terms of the frequency of strategy use between CBT and PBT appears to be fairly wide.

![Figure 4.22: Percentage of strategy use of Korean students in CBT and PBT](image)

Differences were also noticed in the types of strategy use employed among the Korean students. As illustrated in Table 4.18, the most predominantly employed strategy both in CBT and PBT was dictionary; however, there was a greater difference in the proportions of the use of this strategy in each reading environment. In CBT the Korean
students used a dictionary 48 times, or 55.2% of the total strategy use, compared to 45 times, or 43.7% of the total, in PBT. Thus, they demonstrated a much stronger tendency toward the use of dictionary in CBT than in PBT. The second frequently employed strategy use both in CBT and in PBT was inferencing. In CBT they used inferencing 23 times, or 26.4% of the total strategy use, compared to 32 times, or 31.1% of the total, in PBT. The next frequently employed strategy both in CBT and in PBT was inferencing+dictionary, and there is some difference in the use of this strategy between the two environments. They employed the strategy 17 times, or 16.5% in PBT, compared to only 9 times, or 10.3%, in CBT.

<table>
<thead>
<tr>
<th>Strategy Text</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>7 (8.1%)</td>
<td>23 (26.4%)</td>
<td>48 (55.2%)</td>
<td>9 (10.3%)</td>
<td>0</td>
<td>87</td>
</tr>
<tr>
<td>Paper</td>
<td>6 (5.8%)</td>
<td>32 (31.1%)</td>
<td>45 (43.7%)</td>
<td>17 (16.5%)</td>
<td>3</td>
<td>103</td>
</tr>
</tbody>
</table>

Table 4.18: Korean students’ strategy use

Figure 4.23 shows that dictionary use dominated both in CBT and in PBT at 55% (CBT) and 44% (PBT), and inferencing (26% in CBT and 31% in PBT) was a second preference among the Korean students. It also shows that unlike the Mainland Chinese
students (See Figure 4.21), the use of two types of strategies, dictionary and inferencing, was dominant in CBT: over 80% of the use of both strategies occurred in CBT. In PBT, on the other hand, there was a wider use of strategies, including dictionary (44%), inferencing (31%), and inferencing+dictionary (17%). Thus, although dictionary use dominated at 44%, Korean students appeared to demonstrate more variability in their use of strategies in paper-based environment. Regarding their consistent preference for dictionary use over other strategies in both environments, unlike the Mainland Chinese, it appears that the difference in ease of access to a dictionary in each environment was not an important factor for the Korean students, though the lesser use of a dictionary in PBT suggests that it may have played a small role in their decision making.

![Figure 4.23: Percentage of strategy use (Korean)](image-url)
4.2.6.4 Types of Strategy Use Among the Taiwanese Student

As stated earlier, the twelve Taiwanese students employed more strategies in CBT than in PBT: 166 times, or 53%, in CBT compared to 147 times, or 47%, in PBT (shown in Table 4.19). That is, 53% of the total strategy use occurred in CBT and 47% in PBT (see Figure 4.24). Thus, similar to the other two groups (Mainland Chinese and Korean students), the difference in terms of the frequency of strategy use between CBT and PBT is worth noting, though the difference is not substantial.

![Figure 4.24: Percentage of strategy use of Taiwanese students in CBT and PBT](image)

Further analysis also shows differences in the types of strategies employed by the Taiwanese students. As seen in Table 4.19, the Taiwanese students used dictionary most frequently both in CBT and in PBT. Thus, among the three groups, they had the strongest
preference for dictionary use. What also should be noted here is that the proportions of
dictionary use in both environments are almost the same: 99 times, or 60%, in CBT and
89 times, or 60.5%, in PBT. Thus, the nature of the textual environment apparently had
no effect on their use of a dictionary; they were equal opportunity dictionary users.

Inferencing was the second frequently employed: they used inferencing 31 times, or 19% ,
in CBT and 38 times, or 26% , in PBT. Following the use of inferencing, they employed
inferencing+dictionary 24 times, or 14%, in CBT, whereas they employed this strategy
only 7 times (4.8%) in PBT. Meanwhile, they showed little interest in ignoring, at 10
times (6%) in CBT and 12 times (8%) in PBT. In other words, among the Taiwanese
students it was important to define an unknown word, however it was done. This was an
especially interesting contrast with the Mainland Chinese students, who, at least in PBT,
were more likely to employ the strategy of ignoring.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Ignoring</th>
<th>Inferencing</th>
<th>Dictionary</th>
<th>Infer+Dic</th>
<th>Etc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>10</td>
<td>31</td>
<td>99</td>
<td>24</td>
<td>2</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>(6%)</td>
<td>(19%)</td>
<td>(60%)</td>
<td>(14%)</td>
<td>(1%)</td>
<td></td>
</tr>
<tr>
<td>Paper</td>
<td>12</td>
<td>38</td>
<td>89</td>
<td>7</td>
<td>1</td>
<td>147</td>
</tr>
<tr>
<td></td>
<td>(8%)</td>
<td>(26%)</td>
<td>(60.5%)</td>
<td>(4.8%)</td>
<td>(0.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.19: Taiwanese students’ strategy use
Figure 4.25 portrays further perspectives on the strategy use in the two environments, with a comparison of the use of strategies in each environment. It is clear that although there is some variance in relation to the frequency of each strategy use between the two environments, the Taiwanese students appeared to be less influenced by the reading environments in their use of strategies, especially in terms of the dictionary use, compared to the other two groups. Thus, Taiwanese students might have been influenced least by the two reading environments.

Figure 4.25: Percentage of strategy use (Taiwanese)
4.2.6.5 Summary

In sum, the data revealed that there were some differences in terms of the frequency of strategy use between CBT and PBT among the three different student groups (Mainland Chinese, Korean, and Taiwanese), as portrayed in Figure 4.26. What stands out most is that the students of Chinese heritage, both Mainland and Taiwanese, were much more active dictionary users than the Koreans, particularly the Taiwanese, and, as noted earlier, the type of environment involved had virtually no effect on the Taiwanese with respect to dictionary use. In light of these results, it would be interesting to see what kinds of training in dictionary use students receive in those countries. It may be that the dictionary, whether print-based or computer-based, is seen as a more important or useful resource in Taiwan than in Mainland China or Korea. With regard to the two environments, CBT and PBT, there was some variance in the total amount of strategy uses between them, and there appeared to be more variance in terms of the employment of specific strategies. That is, the reading environment, computer-based versus and paper-based, seemed to have some impact on the participants’ use of strategies although the impact was not substantial, particularly among the Taiwanese in their use of a dictionary.
Part Two: Qualitative Results

4.3.1 Introduction

This section describes the interview findings gathered from the semi-structured interviews via a qualitative approach. As explained earlier, all the participants (n=34) were interviewed in this study, although the duration of the interviews varied from participant to participant. In total, the interviews comprised approximately 23 hours of data. The data were analyzed in a different way from the quantitative data that were presented in the previous section. That is, the interview data were analyzed and classified based on the emerging themes for each open-ended question. Thus, given the purpose...
of this study and the interview questions employed, the following section will focus on the participants’ perceptions of or attitudes toward the effect of different reading environments (computer- and print-based texts) and their strategic behaviors in coping with unknown words. In this section, data are presented in terms of representative quotations that illustrate the patterns that emerged from the interview data. In this way the participants’ voices can be heard, thus providing a kind of depth not available in the numerical data reported earlier.

To illustrate not only the holistic views of the participants but also detailed and delicate voices of the participants, this section is composed of two parts. The first part is descriptions of all 34 participants as one group, and the second part provides more detailed descriptions. More specifically, the descriptions of the second part are presented in terms of three categories: participants’ level of vocabulary knowledge (rich versus poor), student status (undergraduate and graduate students), and country of origin (Mainland China, Japan, Korea, and Taiwan). In this way the second part allows for meaningful comparisons across certain important groupings in the study. Interpretations and implications based on the findings of both the quantitative and qualitative data will be delineated in the following chapter.

interviews, some of the participants’ responses seemed to be overlapped by jumping to another questions while interviewing and being interviewed. Thus, sometimes it was not easy for the researcher to excerpt specific parts only related to the specific interview questions.
4.3.2 All Participants

4.3.2.1 Reading Environment (Computer versus Print)

The 34 participants were asked about their attitudes toward, perceptions of, or preference for the two different reading environments, computer-based text (CBT) and paper-based text (PBT), employed in the quantitative portion of the study. In the quotations that appear, initials are used to indicate the country of origin of each participant (CH: Mainland China; JP: Japan; KR: Korea; TW: Taiwan), while numbers indicate which specific participants they were. A list of all of the participants can be found in Appendix I.

With respect to reading environment, their responses revealed that although all the participants used a computer every day, they preferred reading in PBT over CBT. More specifically, most of the students indicated that they predominantly preferred reading PBT when the reading material was for their studies, such as journal articles rather than newspapers or magazines. This preference is captured in the comments below from a Mainland Chinese graduate student:

CH1: … with the newspaper I used to read it every day online, so I am quite used to it. So it’s not problem for me. But if it is article, for example, of what I study like you know dissertation or scholar, scholarship something, well, for those I’d like to print them all to read because I think paper-based text is easier to scan it and also easier to grab the meaning of it. And also it is good for eyes (laughter).

In addition to this, it was reported that if the reading material was short, several participants (CH9, CH10 & TW7) said they might read on screen; however, if the reading material was long, printing the materials out and reading them in the PBT environment
was preferred. It was also reported that in CBT they had difficulties in concentrating on the content of the reading material, identifying the general meaning of a text, or losing track of their reading: “I usually read PBT because I cannot pay all my attention to the reading materials in CBT. So, unless I am really out of time, I print all the materials out,” a Korean undergraduate student (KR1) explained. Thus, some students (e.g., TW4 & TW9) implied that they felt reading in CBT was less efficient in comparison to PBT. A more detailed description was provided by a Mainland Chinese graduate student:

Researcher: Do you usually print articles out to read?
CH10: Yes, I always print them out. Well, I will say that it depends on materials. If it is really important for my class, if it is really long to read, I prefer to read on a paper-based text.
Researcher: Some people say that if the article is really long, they don’t print it out (laughter)
CH10: Oh, really? But if I have to read, I think I will print it out. And one thing is that when I read computer-based text, if it is long, sometimes I, I after I read through I cannot get something. I don’t know why I read paper-based, I could understand more and more thoroughly. May be because in computer I can see in one screen and get this amount of information *(pointing out the amount of the reading material which fits on the computer screen)* … I don’t know why.

Other than the reasons stated above, some students (KR7, CH8, CH9, & TW4) also mentioned that PBT was easier to use when rechecking the content of the reading materials, reviewing them, and for keeping records of the materials. In short, PBT was generally seen as a more practical and workable environment compared to CBT.

However, some students (TW1, TW3 & TW5) mentioned that although they preferred reading PBT, there were some circumstances in which CBT had more appeal. For instance, they felt that since some articles were quite long, they did not print them out so as to save money and paper, as explained by a Taiwanese graduate student:
Researcher: Which one do you like more reading on computer or reading on paper?
TW3: I like paper reading more, but because usually we have to print by ourself. It’s expensive to print so many papers.
Researcher: Yes?
TW3: So, to save money (laughter) I read on computers recently. Because it’s too many papers to print, and it’s so expensive.
Researcher: I know…
TW3: Also, you cannot make it double pages like … because it’s made by computer. I don’t know how to make it…because it’s already set. At first, I print out every paper, but now I find out too many stuffs… I stop do that.

In spite of a strong preference for PBT over CBT, contrary views were also expressed, such as the following interesting comment about CBT from a Korean undergraduate student:

KR9: Umm… so, what is weird is that if I read CBT, I can read fast, summarizing the previous contents quickly. And I feel [inaudible] everything becomes faster. So, when I read CBT I feel my brain works better and faster. That’s why when I read CBT, I read faster than PBT.

4.3.2.2 Effect of Reading Environment on Strategy Use

When the participants were interviewed in relation to the effects of reading environments on their strategic behavior when encountering unknown words, 20 of the 34 participants indicated that there were some differences in their strategic behaviors, including reading behavior. Thirteen of the 34 students reported that they felt either little difference or no difference between the two different reading environments. One participant reported that it was hard for him to explain the answer to this question. Table 4.1 shows participants who identified themselves as having either some difference or no difference in terms of their strategic behaviors according to reading environments.
<table>
<thead>
<tr>
<th>Difference (n=20)</th>
<th>CH3, CH6, CH7, CH8, CH9, CH10, JP2, KR2, KR4, KR6, KR7, KR9, TW1, TW2, TW3, TW5, TW6, TW7, TW9, TW10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Difference (n=13)</td>
<td>CH1, CH2, CH4, CH5, JP1, KR1, KR3, KR8, KR10, TW4, TW8, TW11, TW12</td>
</tr>
<tr>
<td>N/A (n=1)</td>
<td>KR5</td>
</tr>
</tbody>
</table>

**Table 4.20: Participants’ self-perceived behaviors in the effects of reading environments**

Specifically, with regard to differences that the students perceived, about 8 students (CH6, CH7, CH10, TW1, TW6, TW9, TW10 & KR9) reported that they tended to use a dictionary more often when they read CBT.\(^{11}\) When they read CBT, they often consulted the online dictionary, which was easily available to them, leading to more ‘look up’ behavior than when reading PBT. For them, an online dictionary was easier, more convenient, and handier to use. Indeed, it is noteworthy that some students (CH2, CH4, CH10, KR9, KR10 & TW11) stated that when they read PBT, they even turned on the computer and used the online dictionary. The following excerpt from a Taiwanese graduate student captures these views:

Researcher: Do you think there is any difference?
TW9: Umm… when I read on computer, I tend to use more dictionary because it’s convenient and handy. But when I read a paper, I tend to use less dictionary because I am lazy. But sometimes I don’t even use the dictionary when I read a papers.
Researcher: Why do you tend to use dictionary more often in CBT?

\(^{11}\) I would like to note here that while some students clearly indicated more use of a dictionary in CBT or more guessing in PBT, others pointed out more dictionary use in PBT. In case of the latter, the researcher interpreted and counted as less dictionary use, more guessing, or more ignoring in CBT or vice versa. This is because of the fact that most students did not report all the three strategies used at the same time in terms of effects of reading environment.
TW9: When I read on computer, I use online dictionary. .... You can see when I do, I always do copy and paste so, it’s easier for me. Like because if I don’t know this word, I just copy and paste it. Then the word come up.

Of particular interest here is the use of the copy and paste function for dictionary use, a feature unavailable in PBT. This allowed the student to overcome the ‘laziness’ she experienced in CBT. Here, of importance is the fact that she mentioned that she sometimes even did not use a dictionary upon encountering unknown words while reading paper-based texts since it takes more time, and it is not convenient. Lastly, some other students (CH7, CH10 & TW6) mentioned similar views. More perspective was provided by a Mainland Chinese undergraduate student:

CH6: You know, on computer, I can use internet so, I can check up unknown words online.
Researcher: Do you mean you use an online dictionary?
CH6: Yeah. That way is faster. So, I don’t have to open like paper dictionary. So, in that way I look up more words and do not guess that much. You know, looking up dictionary online is faster and easier, that’s why. But, when I read paper-based text, it depends on reading materials. If the reading is textbook or important for my study, I will look up dictionary for sure. But I don’t think I look up dictionary as much words as I do on computer-based. I try to guess unknown words more when I read paper-based text.

Not all of the participants shared these views, as seen in these comments by a Mainland Chinese undergraduate student:

CH8: Umm…, I use less dictionary when I read online.
Researcher: Why?
CH8: Just stress I can’t write it down.
Researcher: Oh. Are you talking about writing down the meanings on the paper?
CH8: Yeah.
Researcher: And then what else? Then, it means you tend to guess or ignore more when you read on computer compared to paper-based text?
CH8: Umm… I guess more plus…
Researcher: When you read on computer you tend to guess more than when you...
read a paper, right?
CH8: Yeah.

About 10 students (CH8, CH9, JP2, KR2, KR4, KR6, KR7, TW2, TW5 & TW7) reported similar views, and the following excerpt provided by a Taiwanese graduate student adds perspective to the use of strategies in PBT as opposed to CBT:

TW5: When I read online, sometimes, seldom I look the words up in the dictionary even if … Because when you read computer-based text, you have to open another one page. You have to copy the word and go back to another window. You know, it’s like a trouble, yeah.
Researcher: Then how do you deal with unknown words?
TW5: I think I just skip.
Researcher: Skip?
TW5: Yeah. For example, if this was really important, probably look it up in the dictionary.
Researcher: What about paper-based text?
TW5: Paper-based? I can circle each word that I don’t understand. For me, I think it’s easier for me to look the words in the dictionary. So, I feel I tend to use more dictionary in paper-based text. Because I don’t have to do extra action like (laughter) open another page, click…. Sometimes you have lots of things on the computer (laughter). You open too many windows, you know. I don’t think it’s necessary to open extra window.
Researcher: Oh, ok (laughter).

However, as stated earlier, several students (CH1, CH2, CH4, CH5, JP1, KR1, KR3, KR8, KR10, TW4, TW8, TW11 & TW12) indicated that reading environment did not have any influence on their strategic behaviors. Rather, it was reported that depending on their purpose of reading or study, they decided whether they would use a specific strategy for coping with unknown words. As one undergraduate student (JP1) said, “It really depends. It doesn’t matter whether I read on computer- or paper-based text. It depends on words and depends on how I feel (laughter), like motivation of study. And I think it depends on
also subject, too…” Another student, a Taiwanese graduate student, offered a similar view:

Researcher: Do you feel you have any difference in relation to strategy use between CBT and PBT?
TW8: Umm, I don’t think so. I think for me personally I will check the words that I don’t know no matter it’s on paper-or computer-based. Because if I don’t know the words, the meaning of the words, I will feel uncomfortable. So, I think it doesn’t matter whether it’s computer or not.

4.3.2.3 Perceptions of Strategy Use

In addition to the effects of different reading environments, all of the participants were interviewed regarding their specific strategy use when encountering unknown words while reading. That is, they were asked under what circumstances, by and large, they employed a specific strategy, such as ignoring, inferencing, looking up dictionary, or etc. in dealing with unknown words. In this interview, the questions were not limited to either computer-based or print-based; rather, they were applied to L2 reading in general.

Accordingly, in the following section, the participants’ descriptions of specific strategy use and rationale for the employed strategy use will be provided. Under what circumstances the participants decided to ignore unknown words will be examined first. Then, in what environment they employed inferencing will be explained. In addition to that, under what circumstances the participants decided to consult a dictionary will be delineated. Lastly, inasmuch as some participants employed multiple strategies, that is, inferencing+looking up in a dictionary, under what circumstances they decided to employ multiple strategies will be examined.
4.3.2.3.1 Ignoring Strategy Use

Although ignoring was not a dominantly employed strategy among the participants, it appears to have had some popularity among them. A valuable point to note is that there was no substantial difference at all in relation to the frequency of use of the ignoring strategy used between CBT (9%) and PBT (11%) among the participants. Nonetheless, of interest is the fact that as aforementioned in the quantitative data analysis, ignoring was used more frequently among low level lexical knowledge students than advanced students.

Among several reasons cited for ignoring unknown words, many participants (CH2, CH5, KR1, KR3, TW3, TW6 & TW8) reported that they tended to ignore unknown words when they did not have enough time to investigate them while reading (i.e., time limitation). They also indicated that they usually ignored unknown words that they thought were not important for reading comprehension. That is, the participants ignored unknown words as long as the words did not hinder their reading comprehension. For example, a Taiwanese graduate participant (TW11) said, “If I can reach about 80-90% of text reading comprehension, I usually ignore the words I don’t understand and I don’t care.” The following comments by two other participants offer more detailed descriptions of this attitude. The first excerpt is from a Taiwanese graduate student. The second excerpt is from a Korean graduate student.

Researcher: When do you ignore unknown words?
TW6: Did I tell you about time?
Researcher: No.
TW6: If I don’t have time, I will just look up the most key words, the most important one. And if I need to a lot of paper in another situation, the reading load is a lot, I may skip and ignore more.
KR2: Most of the time I ignore unknown words that are not important in the sentence. Also, when I can understand the text without any difficulty, yeah, I ignore the words.

Researcher: Ok, then, what about time limitation or reading load?
KR2: Umm, they are also important reasons, but, in general, time limitation and reading load are the main reasons for ignoring the words. But it seldom happens to me because anyhow, I can manage my schedule and reading load during the quarter.

That busy students facing heavy reading loads sometimes chose to ignore unknown words is perhaps not surprising. However, the participants’ comments offer some perspective on the pressures they faced, particularly as students reading in a foreign language, as the next excerpt illustrates:

Researcher: When do you usually ignore unknown words?
KR7: While reading even if I run across unknown words, I ignore them when I can comprehend the contents of the text. That is, if I can understand the content based on the precede words or the following words of the unknown words, I just ignore them.

Researcher: Do you have any reason for that?
KR7: I usually do when I don't have enough time.

The number of unknown words in a text was another factor cited in the use of the ignoring strategy, as noted by a Mainland Chinese student:

Researcher: In what situation do you usually ignore for example?
CH1: Uh, first if the text is not important. So, I just want to get the main meaning of it. For example, if it is news. Secondly, if it is important, but there are too many new words in paper-based text. If it is computer-based text, it is easy to check the words, maybe different.

Apart from the reasons for ignoring unknown words stated above, there were some valuable statements that added more context for use of the ignoring strategy. A Mainland Chinese graduate student (CH2) provided intriguing reasons, which, in part,
can be related to her reading behavior and to her field of study as well. She said that in addition to the time limitation problem, while reading she usually paid more attention to the first sentence and did not pay much attention to the last sentence of a reading passage. She went on to say that when she read a textbook, which has many illustrations, such as tables, charts, or figures, she ignored all unknown words in them, like captions:

CH2: Time limited? That’s important (laughter). And I think the main point may be [inaudible] if there is talk of the graph. (showing me her textbook) If the lots of sentences of this graph, I will ignore it.
Researcher: Which sentences? Oh, ok. Kind of captions?
CH2: Captions?
Researcher: Umm, explanation of graphs or chart?
CH2: Yeah, I just need to read the main point of the reading (laughter)… and some our reading material, there are some tables and… the most important is the first sentence and second sentence, and the last sentence may be not so important. So, if some unknown words show up in the last sentence, I ignore all them.
Researcher: Oh, really? That means when you read you pay more attention to the sentence not each word?
CH2: Yeah. Also, so, like some ‘beautiful girls,’ I ignore the ‘beautiful’ (laughter). Especially the words I don’t know, I just skip. Maybe adj words?
Researcher: What do you mean by adj words?
CH2: (writing down on a paper) adj, this kind of words maybe I don’t know, I ignore them (laughter).
Researcher: Ah, ok, ok. So you just pay more attention to ‘girls’ not ‘beautiful’?
CH2: Yeah (laughter).

In this excerpt, her focus on nouns and not the adjectives that modify them is especially interesting. A Taiwanese participant (TW1) expressed a similar point about ignoring adjectives in sentences. She said, “or it’s (adjective) apparently describe a person or a thing I don’t need to know. I can only need to know when I clearly understand the sentence.” A Korean graduate participant identified the same characteristic in her reading:

KR6: I usually ignore not important words, such as adjectives in the sentence.
Researcher: Ok.
KR6: And also, when adjectives with similar meanings paralleled in a sentence, like this two or three similar adjectives in a sentence (pointing out a sentence), I usually ignore them when I know one of the several adjectives. I mean if I know meaning of one of the several adjectives in a sentence, I think the rest adjectives are similar meanings. Or even if I don’t know the rest adjectives, I feel it’s ok. So I ignore the rest adjectives. I don’t feel they are such important for my understanding.

Adjectives were not the only part of speech ignored by participants. Some (JP2, KR4, KR5 & KR6) reported that they usually ignored proper nouns and adverbs. For example, a Taiwanese graduate student (TW7), said, “Umm… if there are proper nouns? Just like a company name things like that… I ignore them because even if I don’t know them it’s okay for me. So, …” As for adverbs, one Korean participant stated:

KR4: Above all, I ignore proper nouns really a lot, like person’s name, city names… and then what else?
Researcher: What else do you think you ignore?
KR4: Ah, like adverbs. I also ignore adverbs a lot.
Researcher: Why do you ignore them?
KR4: Because adverbs are usually used to emphasize, and they are not as important as subjects and verbs … and because of reading load, just automatically I ignore more words.

Some participants were also selective in terms of prioritizing the frequency and importance of words, with less used words and very specific terminology ignored, as shown in the excerpt from a Korean undergraduate student:

KR5: Umm… in case of unknown words, most of them are like terminology or jargon. But when I read some explanation followed by the words, I can tell a little bit. And trying to think about meanings of the words is hassle, so, I just try to skip them quickly.
Researcher: Oh, ok.

12 She pointed out an example sentence from the reading material prepared for this study. The sentence she pointed out is: In the past few decades, scientists have come up with big, futuristic ways to fight global warming. In this sentence, she pointed out ‘big, futuristic’ as example adjectives that she could ignore.
KR5: Then, like adverbs? I ignore adverbs because I don’t think they are important.

The nature of reading material read also influenced some participants’ use of the ignoring strategy. For example, a Mainland Chinese student (CH9) said, “For me when I read the article from the journal normally, I don’t ignore unfamiliar words but I don’t spend too much time to look up the dictionary. But when I read a novel, there are sometimes some small daily words. I have trouble to catch the meaning, but I still don’t look up the dictionary. I usually ignore them.” Another Mainland Chinese student (CH7), an undergraduate, indicated that if the reading material was for her study, she did not ignore unknown words. She even checked on the pronunciation of the unknown words, despite not necessarily planning to use them in speech. However, if the reading material was a newspaper, i.e., something read for pleasure, she usually ignored the unknown words:

CH7: Umm… in my case sometimes when I read novels on the computer, I usually ignore unknown words. You know, there are a lot of scenic [inaudible] descriptions, and there are a lot of words I don’t know, like deplounge (?). But I ignore it I ignore it.
Researcher: Why do you do that?
CH7: I don’t think they are important. I just move onto the main character, and their talking or something like that.

CH7: Yeah, if I read on the paper, I have to told you that sometimes it’s a very important document like assignment for the writing course. I don’t ignore unknown words. I have to look it up because maybe it’s helpful for my passage, writing. So, I have to look it up. But mostly, uh… also, in a textbook, I am in a chemical engineering. And there are also a lot of unknown words I don’t know. I should not ignore them. I have to look it up. I should know the meaning and pronunciation of the words

CH7: But if it is just a newspaper I mean like Lantern? Usually I will ignore all the words I don’t know (laugher). You know there are various whole pictures or topic on the newspaper. Just read the topic and I know what it means maybe
there is some passage that attract me and go down to some details. But there are some unknown words, I just ignore them. I won’t look it up.

A Taiwanese (TW9) student offered similar thoughts:

TW9: Ignore words? like when I reading on paper, if I get the whole meaning, I will ignore the words I don’t know…. *ellipses So still this kind of question depends on context. Or like I mean if I am going to, I am reading my journal article to write a reflection, then, I have to check at least the key words. but like for this*¹³, I will just get the whole meaning. So, I can read the passage and tell you what’s going on even if I ignore.

Although she placed more emphasis on reading purpose, namely reading for an academic purpose or reading for pleasure, in employing ignoring, she further implies that level of reading material is also a factor used in making a decision about whether to ignore unknown vocabulary. That is, she said, “the purpose and also the level … the level means it depends like how deeply I need to know. For example, if I don’t have to take the test or I don’t have to give the presentation, I think it’s fine and ignore. I don’t care. I think purpose is more important.”

On the other hand, some participants (CH3 & TW4) stated that they rarely ignored unknown words, which is perhaps surprising. For example, a Taiwanese graduate participant (TW12) said, “I seldom ignore unknown words unless I have enough time to look it up [inaudible].” More perspective on this relative avoidance of the ignoring strategy comes from a Taiwanese graduate student, who invoked a fear of misunderstanding as well as the value of language learning:

Researcher: Can you tell me why you don’t ignore unknown words?

¹³ In this context, “this” indicates the reading material itself used for this study.
TW4: Because I want to have complete understanding, and then I won’t misunderstanding article.
Researcher: Oh, ok.
TW4: I think it is also a way to learn English. If I check the words again and again, one day I will learn the words. So, that’s why I don’t want to miss any words.

To summarize, some students reported that they seldom ignored unknown words while reading. However, the participants also provided several circumstances under which they ignored unknown words, and the reasons are listed below.

- time limitation, including reading load
- unimportant words that do not hinder reading comprehension
- too many unknown words in a text
- repeatedly occurring words but still difficult to remember
- most words in the last sentence of a paragraph
- words in figures, chars, or tables
- parts of speech: adjectives, pronouns, and adverbs
- terminology
- reading for pleasure (words in newspapers, novels, or magazines)
- reading material assigned for presentation

4.3.2.3.2 Inferencing Strategy Use

As aforementioned, inferencing was the second most frequently employed strategy among the participants. Of note is the fact that unlike ignoring, there was some difference in terms of the frequency of inferencing use. That is, all the participants by and large demonstrated more use of the inferencing strategy in PBT (31%) than in CBT.
(24%). Also, interestingly, there seems to have been a considerable influence of reading environment in relation to the use of inferencing among the participants, at least those who were in the advanced group. In PBT, the participants in the advanced group employed inferencing more than twice as much as in CBT with a ratio of 40% to 19%. In contrast, there was not a substantial difference in inferencing use among the other two groups, the intermediate and low group.

In the interviews, the participants reported that, similar to the case of employing ignoring, reasons and circumstances for employing inferencing varied from participant to participant. Specifically, some participants (CH5, TW3, TW7 & TW12) indicated that time limitation was one of the reasons for their attempting to guess unknown words, as indicated in the two following excerpts from a Japanese and a Korean participant:

Researcher: What about inferencing?
JP1: I do guess oftenly more than ignoring. I guess when I cannot check dictionary. It’s one reason when I don’t have time because I maybe like on the bus or I am like with my friend. But I don’t have dictionary but I am need to read something. Or sometimes if I can guess from the sentence, I just guess if I don’t need to look up. But if I keep reading.

TW9: I will infer or guess the meaning of the unknown words, if [inaudible] possibly because of the time limit. [inaudible]. Inference meaning how to deal with this unknown words. If I have time, I will look it up in the dictionary very carefully. If I don’t have enough time, I will guess it for the first time and why do is that I will look it up in the dictionary later.

It is interesting to note in these excerpts that the participants, while pressed for time and/or lacking access to a dictionary, still made some attempt to determine the meaning of unknown words as opposed to simply ignoring them.
Likewise, as in the situation of ignoring unknown words, when some students believed the unknown words were not important for their comprehension, they also tended to infer their meanings. A Mainland Chinese undergraduate student (CH6) said, “If I don’t know the words and I think the words are not important, I will just guess it. Guessing is like uh,… I feel I probably have ways to guess it.” This suggests an interesting level of confidence in her/his inferencing ability.

Another interesting perspective on inferencing came from a Korean undergraduate student, who placed a high priority on the value of inferencing:

Researcher: What about guessing?
KR1: Above all, I attempt to guess first. From the beginning of the reading, I appear to guess the meaning, which is very natural for me. So, important thing is whether there is any reading comprehension breakdown or not. If there is no serious comprehension problem and no need to know about the words, I ignore them. Otherwise, I try to guess them. Especially, I just guess like verbs without hesitation.
Researcher: You mean you guess verbs?
KR1: Yes, regardless of any situation or condition.

In this statement, of note is the fact that she attempted to guess meanings of verbs in the first encounter while reading. Another participant (CH3) made a similar point. He said he usually tried to guess the meaning of unknown words first, partly as an attempt to improve his English.

Familiarity of the reading context also led to some inferencing, as stated in the following excerpt from a Taiwanese undergraduate participant:

TW10: When I am reading scientific stuff which is related to my major, I can somewhat guess the words because I am familiar with the contest because of background. But if you want me to read like a Korean-English translated essays, I cannot guess the meaning of the words because I don’t
As numerous studies have shown, context plays a significant role in participants’ attempt to infer unknown words while reading; as one Mainland Chinese student (CH4) said, “I usually guess the meaning based on the context to guess…” In addition, a Taiwanese graduate participant (TW8) stated that she also inferred unknown words based on context and content. She went on to say that “I think it’s a natural process to infer something you read. Because after read some sentences or a paragraph, I will just process it unless I cannot understand.” In a similar vein, it was reported by a Mainland Chinese graduate participant that the place of words in a context or sentence also influenced his use of inferencing:

Researcher: What about guess?
CH1: Yes, sometimes. If, I think, it’s easier to guess the meaning if the word place in important part in the sentence. Like it’s not a verb it’s a verb or not, but it’s not objective? Yeah, it really depends where the words place. Sometimes it’s easier to guess like “novel laureate.” But like the other one, I forgot what word was it. “re-, repercussion”? that word. I don’t think I can get the meaning if I don’t check up the dictionary. Because it’s on the place that … without that word the sentence is still cracked. So, it’s still hard to guess.

Word form was another factor cited in the use of inferencing. Many participants mentioned that they inferred word meanings based on the specific form of a word. More specifically, they attempted to infer meanings of unknown words that had prefixes, suffixes, or derivational forms of the base words. A Mainland Chinese graduate student (CH8) stated, “If I see the words really really familiar … like if it based on some other words just like habitability or like the Nobel laureate, I just guess because of Nobel, as
long as there’s some clue…” Another example cited came from a Korea graduate student (KR8):“In case of guessing, a root of a word in redouble has re-, and prefix like im-, I try to guess.” The following excerpt from a Taiwanese graduate participant echoes this theme:

TW5: I always try to guess the meaning. It depends on the words, when the words have any clues, like suffix, prefix, or roots, like deride. But if there is no suffix, prefix, roots, and if there is no specific synonym, I will probably give up inferring and guessing the meaning.

As another way of inferencing, some participants stated that they tried to infer compound words most of the time. For example, a Mainland Chinese graduate student (CH2) stated, “I always try to guess compound words, like smokestack. Because I know smoke and stack so, I can easily guess the meaning.” “I can guess those words, like smokestack, deride because it’s a combination of two individual words so, I can figure it out,” a Taiwanese undergraduate participant (TW10) said. A Korean graduate student made a similar comment, but also noted the influence of her native language:

KR10: I feel I guess a lot. I tend to guess even meanings of words that I think I know. It seems likely to be the same as in Korean because we cannot learn all unfamiliar words from dictionary. So, while guessing, I feel I also learn the words at the same time. Especially, compound words, like hyphenated words. If I know each meaning of hyphenated or not hyphenated words, I guess almost all the time.

Related to this, some participants (CH1, KR1 & KR9) reported that they also tried to infer meanings of some words based on parts of speech, such as adjectives or verbs. “If I can, I guess adjectives. Actually, I guess adjectives most of the time,” a Korean undergraduate student (KR9) stated. She also said, “In case of verbs, I think I guess about
over 50% of verbs according to context.” She went on to say that “In case of nouns, I ask someone for help if he/she is with me because I feel in general nouns are the most important words in a sentence.”

To sum up, the interviews indicated that the participants were influenced by a variety of factors in their strategic behavior with respect to inferencing unknown words while reading. The reasons cited are listed below.

- time limitation
- comprehensibility of the text
- reading purpose (novels or newspapers)
- unimportant words
- familiarity of the context/background knowledge
- depending on contextual clues
- word forms: suffix, prefix, or compound words
- parts of speech: adjectives or verbs

4.3.2.3.3 Dictionary Strategy Use

As expected, among participants dictionary use was the most favored and frequently employed strategy in both reading environments (CBT and PBT). Although dictionary was the most frequently used strategy, there was a difference between the two environments, as stated previously. That is, the participants generally appeared to use a dictionary more often in CBT than in PBT. In the interviews, a number of reasons for the use of a dictionary were cited by the participants.
Some participants focused on the purpose for reading, which was also cited with respect to two other strategies (ignoring and inferencing). More specifically, if the reading assigned was to help in writing a paper, the students tended to use the dictionary more frequently, though the degree of complexity of the paper could also be a factor. As one Korean participant (KR4) explained, “It depends on the paper, like article with 2-3 page length in an undergraduate course. If I need to write a paper about the article like discussion, I read thoroughly the article and look up all the unknown words because I have to write a paper. To do so, I have to understand the paper completely.” A Taiwanese participant (TW6) indicated that she needed to know exactly what the meanings were and looked up words in the dictionary for her writing assignments. However, if the reading assigned was related to in-class discussion, she did not feel that she needed to know all the words. As she explained:

TW6: Yeah, as long as I have enough time, I use the dictionary. And it also depends on purpose.
Researcher: Oh, ok. Then, let me know about the purpose.
TW6: If the purpose is to well understand the journal articles, then, we are required to write a critical review of it. Of course I need to know exactly what the meaning of it. But, if the article is, the reading article is assigned by my ESL composition instructor like 107, 108, the requirements of the instructor maybe just like us to discuss every paragraph, the meaning of, make point of the every paragraph, then, I don’t need to know exactly what the every words.

The relevance of her writing assignment to her academic field was another factor she cited:

TW6: And besides, if the papers I need to write a critical review it is related to my field, so, I feel like, I feel like the word is more worthy for me to understand. I mean because it’s in TESOL in my field. So I think the words reading in the paper may be useful for me to know because later on I may need to use
the words. But if the paper is, the assigned paper is like science paper or other field, I may not look up the dictionary and look it too so detail.

The kind of text assigned was yet another variable that she identified:

TW6: When I was reading the reading assignment like textbook, I will read faster and I will not look up the dictionary as often as I read the journal article. Because I just need to grasp the meaning in the textbook, but I don’t have to write a critical review. So, I feel that I don’t have to spend that much time as much time as I read the journal article. I will look up much less dictionary if the reading is related to my science class.

In a similar vein, some participants (CH3, CH8, KR4, TW3 & TW9) said they used a dictionary only with respect to some important key words in the text. They said that if their purpose of reading was to comprehend the general meaning of the text, rather than detailed meaning, they did not look up every unknown word in the dictionary. According to them, looking up every unknown word in the dictionary hindered not only their flow of reading but also their comprehension process. “If I try to look it (word) up the dictionary one by one, I kind of get lost and get detailed information instead of the whole picture,” observed one Mainland Chinese student (CH10). Another Mainland Chinese student offered this explanation:

CH9: I don’t like to use the dictionary too much because the purpose of the reading is to get the whole meaning not detail one. And after you look up the dictionary, you still forget the meaning. Also, if the words repeatedly come up may be 5-10 times appearing in the text, I can understand the meaning automatically. The same words in different sentences, I can learn the meaning without looking up the dictionary. It’s a good way not only to know of the words but also to remember the words easily.

Noteworthy here is the fact that when words appeared several times, she felt she could learn them without consulting a dictionary.
In contrast, some students (CH9, KR8, TW9 & TW12) stated that they used the dictionary, even if the words did not seem to be important in the reading and for their reading comprehension as well, as long as the words appeared frequently in the reading materials. For example, a Mainland Chinese student (CH2) said, “If the words show up very frequently in the article, and if I get totally lost in the paragraph because of some words I don’t know, I use the dictionary.” A Korea participant (KR8) stated, “I look up the dictionary when the words are important, and when I cannot guess. But when the words come up again and again even if the words are not important, I look up the words in the dictionary by stopping ignoring them.”

Looking further at dictionary use, some students (KR2 & TW10) explained that they saw the dictionary as a valuable resource. For instances, a Taiwanese student (TW12) stated:

TW12: I use dictionary a lot. It is my good friend (laughter).
Researcher: Why do you think like that?
TW12: Because it help me to understand the meanings a word contains. Because words have different meanings depending on the context, right? So, for example, you know one or two meanings of a word but the meaning is not appropriate in the context and you look up the dictionary then, based on the context you find out the appropriate meaning, right? Then, you can learn another meaning, right?

*eclipses*

TW12: For example, maybe this word has six meanings and I just know one or two meanings in the context. But at the same time I know there are four other meanings, yeah. Because when I look in the dictionary, I try to figure it out. But in another situation is that maybe this meaning appropriate is one but because when I look it up in a dictionary I usually read a whole things. So, at the same time I learn other meanings.
She also indicated that even when she knew the meanings of the words, she checked the dictionary to figure out the most appropriate meanings of the words depending on their context of use. Similarly, a Korean graduate student (KR2) reported that she even looked up the words that she knew the meaning of because she recognized that some words have multiple meanings and wanted to make sure she had identified the most appropriate meaning.

Meanwhile, other participants said that they looked up words in the dictionary depending on syntactic roles that the words played (whether the words were subjects, verbs, or predicates) or parts of speech in the sentence. There were contrasting views in relation to which parts of speech or syntactic roles the participants placed more emphasis on when using the dictionary. For example, a Korean undergraduate student (KR5) stated that if the unknown words were subjects, he did not always consult a dictionary. However, if the words were verbs, he always looked them up. Other participants made similar observations:

KR5: In fact, I cannot guess verbs that I don’t know. So, I feel I look up the verbs in the dictionary very frequently because verbs are most important. And even if I know the verbs, I look up the verbs in the dictionary, which is helpful. Verbs are difficult to memorize and cannot easily come up with in a conversation.

KR6: In a sentence pattern, I can understand the sentence without knowing meaning of adjectives or adverbs. But, if I don’t know meanings of verbs, which describe like the circumstance, I feel as if I don’t know the sentence because I cannot figure out the sentence and cannot guess. And among subject, verbs, and objects, if I don’t know subjects, I look up the subjects in the dictionary. Then, I look up the verbs in the dictionary. Usually among subjects, verbs, and objects, I feel I look up the subjects and objects, which are key points in the sentence, in the dictionary except for adverbs.
Interestingly, a Korean graduate student (KR10) also reported, “If I don’t know verbs in the very first paragraph of the text, I always look up the verbs in the dictionary for sure.” She stated that if she did not know verbs in the first paragraph, she felt she could not understand the whole text. That is why she always checked the dictionary for verbs which appeared in the first paragraph. A Mainland Chinese graduate student (CH10) provided a similar view: “I usually check the words in the dictionary for verbs and nouns because I just feel I should know for my reading comprehension and to improve my English too.”

Likewise, a Taiwanese graduate student (TW5) said, “I think nouns are just a thing, and it’s not important. So, I tend to look up verbs in the dictionary more often than nouns. Yeah, adjectives, too. So, I think I look up verbs and adjectives in the dictionary more often than nouns.” By contrast, another participant articulated a contrasting view. This Korean undergraduate student (KR9) stated: “I think nouns are the most important words in a sentence, especially when the nouns are placed in subjects in a sentence. If I don’t know the subjects, I have problems in comprehending the sentences. So, I tend to use the dictionary for nouns more frequently.”

In addition to the several grounds for using the dictionary already cited, other miscellaneous but noteworthy rationales were also found. First, some participants (JP1 & TW7) reported that they used the dictionary when some words appeared to be familiar, but they could not remember their meanings. “I use the dictionary when I have no memory about the words. I mean for some words, I have feeling like I read this word
before and maybe I can guess. But for some words, I cannot remember if I see [inaudible]
so, I will look up the dictionary,” a Taiwanese graduate student (TW7) said.

Second, apart from their academic field, when some students were not familiar
with the reading material, that is, they lacked background knowledge, they tended to use
the dictionary to unravel the meaning of unknown words. A Korean graduate student
(KR10) reported:

**KR10:** In case of my study field, I can read the material without looking up the
dictionary on the whole. But, a little bit different from my study field, like
feminism or racism, with which I am not familiar, I use the dictionary a lot. Also,
depending on the writer’s writing style, which is also different from
my major, and the writer seems to use different words with the same
intention or meaning so, I use the dictionary a lot, too. And when the words
are very unfamiliar and long words, I look up the words in the dictionary.
Especially, I feel strong force to look up the dictionary with long words,
which look like foreign words.

Lastly, a few students (CH7 & CH10) stated that even if they might know the
meaning of the words, when they did not know how to pronounce them, they looked up
the words in the dictionary. One Mainland Chinese student (CH10) offered the remarks
below. Of special interest here is that she addressed the importance of pronunciation for
successful communication and thus a reason for consulting a dictionary.

**CH10:** Maybe I know the meaning, but sometimes I don’t know how to pronounce
them. Then, I use the dictionary.
**Researcher:** Can you elaborate a little more about it?
**CH10:** Well, I don’t know why but may be because of the way I learn English? If I
don’t know how to pronounce it, when I speak, I am more like to hesitate to
[inaudible] seems like confidence? And also, if I cannot pronounce it, I am
not sure whether I am saying the right way to people, listening to me. I feel
sometimes when people don’t understand me I feel maybe something is
wrong with my pronunciation or stress something like that that’s why...
Another Mainland Chinese graduate (CH1) student made a similar point: “Sometimes I use the dictionary not only to check the meaning but also to check the pronunciation because I don’t feel comfortable if I know only the meanings of the unknown words.”

In summary, regardless of the reading environment, students’ most favored strategic behavior when encountering unknown words was using a dictionary. For dictionary use, similar to the other two strategic behaviors more frequently cited (ignoring and inferencing), the participants offered several reasons for using the dictionary, and the reasons are listed below.

- reading purposes: writing a paper / reading for detailed information
- words in the articles rather than textbooks
- words or reading materials related to their study fields
- frequently occurring (unimportant) words
- appropriate meaning in context
- parts of speech or syntactic roles: subjects, verbs, nouns, or adjectives
- looks familiar but cannot guess or recall
- lack of background knowledge
- pronunciation check-up

4.3.2.3.4 Multiple Strategy Use: Inferencing+Dictionary

Several studies have shown that learners tend to use multiple strategies in dealing with unknown words. This study also found that the students demonstrated multiple strategy use when facing unknown words. In this study, the participants’ multiple strategy
use predominantly included employing inferencing and consulting the dictionary as well, that is, inferencing+dictionary. Interestingly, this study reveals that there was little or no influence in terms of environment on the participants’ employing inferencing+dictionary. In fact, the participants demonstrated almost the same amount of inferencing+dictionary use in each environment. As shown earlier, they used inferencing+dictionary 43 times (11%) in CBT and 37 times (10%) in PBT.

The interview data provided some insight into this combined strategy use. There tended to be one primary reason for the selection of this strategy: the students felt a need for confirmation of their inferences. As a Japanese undergraduate student (JP2) reported, “When I am not quite sure of the meaning after I guess, I use the dictionary to make sure, especially I do a lot on verbs to make sure if I guess the words.” Two other participants displayed the same kind of reasoning:

Researcher: Can you tell me why you use this strategy (inferencing+dictionary)?
KR: In my case, I use dictionary of most the time to confirm my guessing. Even after I guessed the meaning, if the guessed meaning does not make sense in the context, I use the dictionary to confirm that I guess like nouns.

CH2: When I don’t feel comfortable with the meanings, I mean the meanings that I guess, I usually use the dictionary to check whether my guessing was correct or not.

Similarly, a Taiwanese graduate student (TW12) pointed out that when she did not have enough time to use the dictionary to confirm a meaning, she made a list of the words that she tried to guess. Then, she looked the words up the dictionary later, when she had more time:
TW12: If I have time, I will look it up in the dictionary very carefully. If I don’t have enough time, I will guess it for the first time and why do is that I will look it up in the dictionary later if I, another day, maybe another day or another time if I have time, I remember I need to check this meaning, yeah. Researcher: Oh, ok. Then, how do you remember the words you guessed?
TW12: Sometimes if I miss some unknown words in today, and if I if I realized [inaudible] I don’t have time, maybe I will pick up a piece of paper and then write it down maybe a couple days later I will look it up later to make sure.

She added that through this approach, she could improve her lexical knowledge.

To summarize briefly, the participants’ primary reason for engaging the combined strategy involving inferencing and dictionary use was to monitor and confirm the meanings derived from their inferencing.

4.3.2.3.5 Dictionary Usage: monolingual versus bilingual dictionary

As already seen, dictionary use was common among the participants. As this became apparent during the study, it seemed best to inquire into the participants’ preferences among different kinds of dictionaries available in online and print settings. In spite of positive perceptions of the traditional paper dictionary, almost none of the participants reported that they preferred or used a traditional paper dictionary as opposed to either an electronic or online dictionary. This is mainly because of its perceived inconvenience, such as being time-consuming to use and heavy to carry. Also, except for a few participants, who reported that they used only an electronic dictionary (CH5, JP1, KR4 & TW12) or only an online dictionary (CH2, CH4, CH10, KR9, KR10, TW7 & TW11), most of them indicated that they used each of them, depending on their availability. Thus, this section examines the findings relative to their reactions to different types of dictionaries first. Of particular interest was whether the participants preferred
using a monolingual or bilingual dictionary, or whether it was mainly an online
dictionary or electronic dictionary. Then, brief descriptions of the participants’ responses
to using either an online dictionary or electronic dictionary will be provided. The
responses revealed that a great number of participants (CH1, CH2, CH4, CH5, CH7, CH8,
JP1, KR4, KR5, KR7, KR10, TW1, TW2, TW3, TW4, TW5, TW7 & TW11) used a
bilingual dictionary when coming across unknown words. There were several reasons for
their preference among the participants. Some of the participants stated that definitions in
a bilingual dictionary were easier to understand, which was perhaps not surprising, since
the students could read the definitions in their native language. This, in turn, made it
easier to use than a monolingual dictionary. A Taiwanese graduate student (TW11) said,
“I usually use English-Chinese dictionary because it’s more familiar and easier to
understand.” A Mainland Chinese graduate student made a similar point:

   Researcher: Why do you usually use English-Chinese dictionary?
   CH2: I think it’s more convenient to use and easier to understand. And it’s faster to
   use. You know sometimes it’s hard to remember definitions and understand
   when I use English-English dictionary (laughter). Also, because English-
   English dictionary, maybe I will sometimes misunderstand something.

   However, not all of the participants spoke favorably of the bilingual dictionary.
For instance, some participants (CH3, CH9, KR2, KR3, KR9 & TW10) reported that the
bilingual dictionary sometimes did not provide accurate or appropriate definitions of
words in comparison to a monolingual dictionary, as seen in the following comment from
a Mainland Chinese graduate student:

   CH9: I usually try to use English-English dictionary rather than English-Chinese
dictionary
   Researcher: Why?
CH9: Because I feel English-English dictionary seems better. Sometimes I cannot understand meanings in Chinese because it is translated. Also, even if I can understand the meaning, I think it’s better to look it up in English meaning so, I can know in what situation I can exactly use the word like actual use.

Moreover, some students mentioned that although using a monolingual dictionary required more time, they felt that using a monolingual dictionary was more useful for them in terms of improving their English.

In the same vein, it was found that, while some participants (CH6, JP2, KR6, TW6, TW9 & TW12) initially tended to use a bilingual dictionary to obtain the meanings of unknown words, they then went to a monolingual dictionary when the meanings were still unclear. A Japanese undergraduate student (JP2) said, “I use English-Japanese first and then if I don’t understand and if Japanese is too complicated, I look up in English-English dictionary.” A Taiwanese graduate student elaborated on this situation:

Researcher: Do you usually use English-Chinese dictionary or English-English dictionary?
TW9: Both.
Researcher: Why?
TW9: Why? I remembers someone tell me you can get closer meaning than …. Sometimes I cannot get the real real (emphasis) meaning from the Chinese. So, when I come to that situation, I will check English dictionary. But not I mean like this kind of thing I will just go check Chinese-English.
Researcher: So, you try English-Chinese dictionary first, but when you cannot find an appropriate meaning, you use English-English dictionary.
TW9: Yeah, sometimes Chinese dictionary is really weird. I don’t know why? So, I just go back… And like my English-English dictionary, they can get like a lot of similar words or different words, or and they even have like all kinds of explanations so you can check each one. So, it depends on situation. When the Chinese meaning is not clear to you, I prefer English-English dictionary.
Another interesting point that emerged was that some students (KR5, TW3 & TW4) indicated that they relied on a monolingual dictionary for their writing assignments. The main reason appeared to be that the monolingual dictionary provided resources especially helpful in writing. As a Taiwanese graduate student (TW3) said, “I usually use English-Chinese dictionary. But I use English-English dictionary only when I write a paper for my class. Then, I can find out many synonyms easily, and I can avoid using the same words repeatedly in the paper.”

4.3.2.3.6 Dictionary Usage: electronic versus online dictionary

Another interesting subject that emerged in this study was the students’ preference for either an electronic dictionary or online dictionary. As stated earlier, except for some participants, most participants used each of them, with availability a key factor in their decision. Furthermore, availability was related to the type of textual environment involved. For instance, when they read a computer-based text, and when the Internet was available, they usually used the online dictionary; by contrast, when they read a print-based text, they used an electronic dictionary rather than a traditional paper dictionary.14

The interviews showed that the foremost reasons for using the electronic dictionary were its convenience (easy to carry) and its ease of use. Because of this, a majority of the students stated that they used an electronic dictionary. As a Taiwanese

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14 Of 34 participants, only 4 students brought a paper dictionary for use in this study. However, all 4 students said that inasmuch as their electronic dictionary ran out of batteries at the time of the study, they had no choice but to bring their paper dictionary. Thus, it is indicated that if their electronic dictionary was available, they would bring the electronic dictionary, not a paper dictionary.
graduate student (TW7) said, “Electronic dictionary is easy and convenient. So, I always carry this with me.” The electronic dictionary was also seen as more effective. For instance, when the spellings were complicated and confusing because of some derivational forms being used, the electronic dictionary was easier to use in finding the appropriate spellings and words. A Japanese undergraduate student (JP1) elaborated on this point:

Researcher: when you read on computer, how often do you use online dictionary?
JP1: Ah, maybe I don’t use … I use this (pointing out her dictionary).
Researcher: Why?
JP1: Because it’s handy and there’s history buttons I can go back to look the meaning again.
Researcher: Really? Is there a kind of trace back system?
JP1: Yeah. So, if I put the history, then, there’s vocabulary that I checked. I don’t have to retype again.

Furthermore, a Mainland Chinese undergraduate student (CH5) commented that, “Even I read on computer, I still use my electronic dictionary instead of online dictionary. Because I think sometimes online dictionary\(^{15}\), they don’t have more examples you know. They sometimes just list the meaning of the words. And even though they have some examples of the words, it’s not accurate. I am just talking about English-Chinese online dictionary.” Another interesting point was that the online dictionary seemed to be less useful or less professional, in particular for specialized terminology. A Taiwanese graduate student (TW4) said, “Sometimes I use online dictionary, but I cannot use online

\(^{15}\) It is important to mention here that apart from the problems that this student mentioned, some students stated the contrasting view in relation to the advantage of online dictionary, including more examples.
dictionary to find some professional terms. It’s only like the words I am using for usual but not for academic words. So, I usually use my electronic dictionary.”

However, some participants (CH2, CH4, CH10, KR9, KR10, TW7 & TW11) reported that due to its even greater convenience, they preferred to use an online dictionary. When the Internet was available, many would turn on the computer and use the online dictionary. A Mainland Chinese student (CH4) said, “Even when I read some paper-based text, I also look up online dictionary. Maybe I am less patient to spend time looking up the paper dictionary. Because if I use online dictionary, it’s more quickly.” A Taiwanese student elaborated on this point:

TW11: I usually use online dictionary when I read on computer.
Researcher: Then, what about when you read a paper-based text?
TW11: If I have a computer, I use online dictionary. But, if I don’t have a computer, I use electronic dictionary.
Researcher: Why do you usually use online dictionary?
TW11: Because I can get more information in online dictionary than electronic dictionary. And it’s more helpful.
Researcher: Then, in what way is it more helpful or useful?
TW11: For example, online dictionary has more example sentences with the words. So…

Furthermore, in relation to its convenience, one Taiwanese student (TW6) noted, “Because in computer, the online dictionary, I can simply just copy and paste the unknown words on the dictionary. Therefore, it will be faster for me to look up the meaning.”

To sum up, the participants’ responses revealed a variety of reasons for their preference of dictionary types. Many participants showed a strong preference for a bilingual dictionary; however, some participants reported using either a monolingual
dictionary or a combination of bilingual and monolingual dictionary as well. In addition, depending on its availability, most participants used either an online dictionary or an electronic dictionary. However, some participants cited, by and large, a strong preference for only an online dictionary or an electronic dictionary as opposed to using whichever was best for the circumstances at hand.

4.3.3 Three Groups: Level of Vocabulary Knowledge, Student Status, and Country of Origin

This section will take a different look at the participants by focusing on them comparatively with respect to their perceptions of or attitudes toward the effect of different reading environments (computer- and print-based texts) and their strategic behaviors in coping with unknown words. For this purpose, the participants were placed into three categories: levels of vocabulary knowledge (rich versus poor vocabulary knowledge), student status (undergraduates versus graduates), and country of origin (Mainland China, Japan, Korea, and Taiwan).

4.3.3.1 Levels of Vocabulary Knowledge: Rich versus Poor

Of the 34 participants who were interviewed, the upper 6 students, who obtained the highest scores on VLT, were selected and categorized as rich vocabulary knowledge participants. In contrast, the lower 6 students, who obtained the lowest scores on VLT, were selected and categorized as poor vocabulary knowledge participants. Those who had rich vocabulary knowledge were composed of one Mainland Chinese, two Koreans, and
three Taiwanese. Those who had poor vocabulary knowledge consisted of one Mainland Chinese, One Japanese, and four Taiwanese. Table 4.1 presents further demographic information about these 12 participants.

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*Note. R (Rich); P (Poor); U (Undergraduate); G (Graduate); CH (Mainland China); JP (Japan); KO (Korea); TA (Taiwan)*

**Table 4.21**: Description of the participants (rich versus poor vocabulary knowledge)

4.3.3.1.1 Reading Environment (Computer versus Print)

As stated earlier, although all the participants used a computer every day, they preferred reading PBT over CBT. A further detailed analysis also supported this result. That is, the interviews with these 12 participants, who had either rich vocabulary knowledge (RVK) or poor vocabulary knowledge (PVK), revealed that regardless of their levels of vocabulary knowledge, they predominantly preferred reading PBT over CBT.
More specifically, when the participants read for pleasure, such as magazines or newspapers, they read in CBT; on the other hand, when they read for their studies, such as journal articles or other scholarly work, they always read PBT. They (JP1, CH1, KR2, KR4, TW1, TW6, TW9 & TW10) reported that reading in PBT was easier to read with less fatigue (especially with their eyes), to catch the meaning of the content, or to pay more attention to their reading than in CBT. Moreover, PBT was easier to use in terms of going back to the reading materials to confirm comprehension (TW2) and for taking notes while reading (CH8). It was also reported that since they (TW5 & TW7) could easily lose track of their reading in the CBT environment, they preferred not to read CBT.

4.3.3.1.2 Effect of Reading Environment on Strategy Use

Five of 6 participants’ responses (CH8, TW1, TW2, TW6 & TW9 versus KR2, KR4, TW5, TW7 & TW10) from each vocabulary group reported that there were differences in their strategic behaviors depending on the reading environments. Some of them reported that they tended to use more strategies in CBT due to easy access to the Internet; others felt that they used fewer strategies in PBT due to either laziness or time limitations. The remaining two participants (CH1 & JP1) reported that their strategic behaviors were not different across the environments. Rather, reading purposes (either academic or pleasure) or motivation of the study can decide their strategic behaviors.

When the 12 participants’ responses were compared to the quantitative data for the advanced and low groups, from which the 12 participants were selected for interviews, the same patterns were seen. That is, there was still a split across the two environments. On a more general level, the same number of participants (5 of 6) from each group
reported differences in their strategic behaviors across the environments. However, the participants in the advanced group employed far more strategies in CBT than in PBT, with a 12% difference between the two environments compared to the participants in the low level group, and with a 2% difference across the two environments. In other words, there was a greater degree of variation among the low learner group students compared to the advanced students in terms of their perceptions of the effects of reading environments and their strategy use across the two environments.

4.3.3.1.3 Perceptions of Strategy Use

Six participants’ interviews from each group (rich versus poor) revealed under what circumstances, by and large, they employed a specific strategy, such as ignoring, inferencing, looking up dictionary, or etc. in dealing with unknown words.

Among several reasons for ignoring unknown words, some of them, such as unimportant words, time limitation (especially related to reading load), and reading purposes, were reported by both groups. More specifically, while 3 of the 4 PVK participants (CH8, TW1 & TW2) reported that they tended to ignore unimportant words, 3 of 4 RVK participants (CH1, KR2 & KR4) were a little more selective, as they indicated that they also tended to ignore unknown words, but that this depended on reading purposes. Employing ignoring based on parts of speech was also reported by 3 RVK participants (KR4, TW5 & TW7). Another RVK participant (CH1) reported that when there were too many known words, she tended to ignore them. By contrast, 1 RVK participant (TW5) reported that they employed ignoring when there were only a few
unknown words. He also reported that he ignored specialized terminology. Thus, level of vocabulary knowledge was a factor in their use of this strategy.

In terms of several reasons for employing inferencing in coping with unknown words, 3 PVK participants (CH8, TW1 & TW9) and 4 RVK participants (KR4, TW5, TW7 & TW10) indicated that they employed inferencing based on word forms, such as affixes or compound words. Another category that stood out to some degree was inferring word meanings based on contextual clues: 3 PVK participants (JP1, TW2 & TW9) and 2 (CH1 & TW7) RVK participants. It was also interesting to note that 2 PVK participants (CH8 & TW2) indicated that they tended to infer word meanings when the words looked familiar to them. Here, too, then, level of vocabulary knowledge appeared to have some impact on use of a strategy.

With respect to reasons for consulting a dictionary, there were no strong tendencies for either the RVK or PVK groups other than 4 PVK participants (CH8, KR4, TW7 & TW9) reporting that they looked up what they perceived to be key words. For all of the other categories related to dictionary use, no more than one or two participants indicated some usage of the strategy, thus suggesting that level of vocabulary knowledge was not an important factor when it came to reasons for using a dictionary. This may seem surprising, as it could be assumed that poor vocabulary students would feel inclined to use a dictionary to address their vocabulary problems and thus might cluster around some dictionary uses. Instead, they spread their strategy uses across a range of options.

With regard to the 12 participants’ perceptions of types of dictionary, one tendency that stood out was that 4 of 6 the RVK participants (CH1, KR4, TW5 & TW7)
and 4 PVK participants (CH8, JP1, TW1 & TW2) reported that they favored a bilingual dictionary. On the one hand, 2 of the RVK participants (KR2 & TW10) preferred a monolingual dictionary, but none of the PVK participant preferred it. Also, 2 PVK participants (TW6 & TW9) preferred a combination of bilingual and monolingual dictionary, but none of the RVK participant preferred it. It was also reported that most participants in both groups used either an online or electronic dictionary, depending on availability, suggesting that level of vocabulary knowledge did not impact on their preferences.

4.3.3.2 Student Status: Undergraduate versus Graduate Students

This section will illustrate further analysis of the interview data according to the participants’ status, that is, undergraduate versus graduate students. As stated in the beginning part of this chapter, 14 undergraduates and 20 graduates were participated in the present study.

4.3.3.2.1 Reading Environment (Computer versus Print)

The 12 participants in the level of vocabulary knowledge category showed a definite preference for PBT over CBT when they read for academic purposes. This preference also reflects both the 14 undergraduate students’ and 20 graduate students’ perceptions of or attitudes toward reading environment. Moreover, reasons for their preference shared common grounds with those of the 12 vocabulary knowledge participants. For example, nearly all of them felt more comfortable with and could pay
more attention to their reading in PBT compared to CBT. Thus, students’ status was not an important factor with respect to preference for reading environment.

4.3.3.2.2. Effect of Reading Environment on Strategy Use

Contrary views were reported in terms of the effect of reading environment between the two groups (for this item, 13 undergraduate and 20 graduate students). Their remarks indicated that while 9 of 13 (69%) undergraduate students (CH3, CH6, CH7, CH8, JP2, KR4, KR6, KR9 & TW10) stated that their strategy use tended to be different depending on reading environment, a somewhat lower percentage, 55% (11 of 20), of graduate students (CH9, CH10, KR2, KR7, TW1, TW2, TW3, TW5, TW6, TW7 & TW9) reported that their strategy use was different across the environments. Some of them reported that they tended to use more strategies in CBT due to its convenience, a factor not cited for PBT. Also, 4 undergraduate and 9 graduate students who indicated no difference across the environments reported that reading purpose was the main reason for their attitude; they made decisions based on what they had to read, and why.

Interestingly, the quantitative results painted a somewhat different picture in this case, at least for the undergraduates. Although almost 70% of the undergraduate students cited the effect of reading environments, the difference in terms of their actual strategy use between CBT (125 times, or 47.5% of the total strategy use) and PBT (138 times, or 52.5% of the total strategy use) was not as noticeable as their remarks indicated. There was more consistency among the graduate students: CBT (261 times, or 54% of the total

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16 As mentioned in the previous part, 1 undergraduate Korean student (KR5) reported that it was hard for him to explain about this question.
strategy use) and PBT (221 times, or 46% of the total strategy use), figures that closely resembled their qualitative preferences, as shown earlier (55% preferred CBT). The combination of qualitative and quantitative results in this case makes it difficult to arrive at a conclusion about the effect of student status.

4.3.3.2.3 Perceptions of Strategy Use

Fourteen undergraduate and twenty graduate students reported on the circumstances under which they employed a specific strategy, such as ignoring, inferencing, looking up dictionary, or etc. in dealing with unknown words.

First, more graduate students (9 of 20) cited time limitation (including reading load) than undergraduate students (5 of 14). Similarly, more graduate students (12 of 20) reported ignoring unimportant words than undergraduate students (5 of 14). On the other hand, more undergraduate students (5 of 14) reported reading for pleasure as a reason for ignoring words than graduate students (4 of 20). Besides that, two graduate students (TW4 & TW12) reported that they seldom ignored unknown words, and one undergraduate student (CH3) reported that she rarely ignored unknown words. Interestingly, more undergraduate students (6 of 14) reported parts of speech as reasons for employing ignoring than graduate students (5 of 20).

Similar to the rich and poor vocabulary knowledge participants’ use of inferencing, many students indicated that they inferred unknown words based on contextual clues or word forms (including compound words). More graduate students (11 of 20) tended to use contextual clues to infer meanings than undergraduate students (5 of 14). Likewise, more graduate students (10 of 20) cited word form as a reason for
inferencing than undergraduate students (6 of 14). With respect to other applications of inferencing, no other tendencies emerged.

Interestingly and surprisingly, especially within the academic context of this study, when it came to using a dictionary while writing a paper, only 4 undergraduate and 5 graduate students indicated that they did so. It would be reasonable to expect higher figures for both groups given that they were writing in a second language and would presumably need some assistance with respect to vocabulary. It was also interesting to see that only one of the undergraduate students reported using a dictionary to find the appropriate meaning of a word in a particular context, while 4 of 20 graduate students did so. Eight graduate students reported using a dictionary for frequently occurring unimportant words; however, none of the undergraduate students reported doing so.

Another interesting finding is that about the same percentage of undergraduate (2 of 14) and graduate students (3 of 20) stated that they used a dictionary at the beginning of a reading, but later in the reading they did not do so. They explained that they become more familiar with the unknown words as they went along and thus felt no need to keep looking up words. Interestingly, more undergraduate students (6 of 14) reported that the part of speech of a word influenced their dictionary use than graduate students (6 of 20).

Of particular interest here is that consulting a dictionary for verbs was cited by 9 participants (4 undergraduate and 5 graduate students) compared to nouns (4 undergraduate and 2 graduate students) or adjectives (2 graduate students).

Pertaining to their perceptions of types of dictionary, 5 of 14 undergraduates reported a preference for a bilingual dictionary over a monolingual dictionary, whereas
12 of 20 graduate students cited a preference for a bilingual dictionary. Moreover, 6 of 20 graduate students used, by and large, only an online dictionary, while just 1 of 14 undergraduate students used the online dictionary. Meanwhile, just 3 of 14 undergraduate and 1 of 20 graduate students reported that they used an electronic dictionary.

Looked at collectively, the results in this section suggest that student status generally was a factor impacting on students’ dictionary use practices and attitudes toward dictionaries.

4.3.3.3. Country of Origin: Mainland China, Korea, and Taiwan

10 Mainland Chinese, 2 Japanese, 10 Koreans, and 12 Taiwanese students participated in the present study. As in the quantitative analysis, given the unbalanced number of participants, the two Japanese were excluded from the analysis in this section. Thus, illustrations of 10 Mainland Chinese, 10 Koreans, and 12 Taiwanese will be provided.

4.3.3.3.1 Reading Environment (Computer versus Print)

Apart from one exceptional participant (KR9), who was an undergraduate student and indicated partiality for CBT over PBT, the participants’ perceptions revealed that regardless their nationality, all of them showed a strong preference for PBT over CBT. That is, they reported very similar views and reasons for their favor, compared to the other two categories (rich versus poor vocabulary knowledge and undergraduate versus graduate students). Being comfortable to read, easy to understand and follow contents, or
easy to keep records of the reading material in PBT are among several reasons for their preference by many participants.

4.3.3.3.2. Effect of Reading Environment on Strategy Use

Six of 10 (60%) Mainland Chinese and 8 of 12 (67%) Taiwanese participants reported their strategic behaviors were different across the environments, while 5 of 9 (56%) Koreans participants reported their behaviors were different between CBT and PBT. With respect to reporting no difference across the two environments, 4 of 10 (40%) Mainland Chinese, 4 of 9 (44%) Koreans, and 4 of 12 (33%) Taiwanese were in this category. Overall, it appears that the Taiwanese were most influenced and the Koreans least influenced by the reading environments in this regard, though in each case there was a fairly large gap between the CBT and PBT uses. Whether these results suggest that country of origin made a difference is difficult to say. On the one hand, the participants from the two countries dominated by a Chinese heritage were more strongly inclined in this regard than the Koreans. On the other hand, participants from all three countries demonstrated a similar tendency of conducting more strategy use in one environment than another. The conclusion may be that country of origin had a minor effect in this context.

When compared to the quantitative analysis, the story remained basically the same. For the Mainland Chinese, the quantitative analysis showed a 10% difference in their strategy use between CBT (117 times, or 55% of the total strategy use) and PBT (97 times, or 45% of the total strategy use). As with the qualitative results, Koreans showed the least perceived difference between CBT and PBT among the three groups. In their
actual approach, they employed more strategies in PBT (103 times, or 54% of the total strategy use) and CBT (87 times, or 46% of the total strategy use). In other words, here, too, the reading environment affected strategy use, and the same pattern was seen as in the quantitative results, leading to the conclusion that country of origin was a factor in a small way.

4.3.3.3.3 Perceptions of Strategy Use

As has already been seen in this chapter, ignoring was one of the strategies the participants were more likely to engage in, and in a variety of ways. For instance, 5 Mainland Chinese and 3 Koreans stated that when they read for pleasure they tended to ignore unknown words, a practice which was not reported at all by the Taiwanese participants. Also, 1 Mainland Chinese, 3 Taiwanese, and 6 Koreans indicated that, depending on the parts of speech involved, they might ignore unknown words. On the whole, though, no major patterns emerged that suggested that country of origin was a factor in the use of the strategy of ignoring.

With respect to inferencing, use of contextual clues and word forms stood out somewhat in terms of their frequency of use. Seven of 12 Taiwanese, 5 of 10 Mainland Chinese, and 3 of 10 Koreans stated that they relied on contextual clues for inferencing. In the case of inferring meanings from word forms, 2 of 10 Mainland Chinese, 6 of 10 Koreans, and 7 of 12 Taiwanese employed this approach. These results do not suggest any clear patterns in terms of country of origin.

In terms of reasons for consulting a dictionary, there seemed to be strong tendencies for reading purposes, key words, or frequently occurring (unimportant) words
among the three groups. However, interestingly, there were two categories cited by specific participants. That is, while 7 Korean participants (KR1, KR3, KR5, KR6, KR8, KR9 & KR10) cited parts of speech reasons for dictionary use; only three Mainland Chinese participants (CH1, CH9 & CH10) and one Taiwanese (TW5) did so. Another interesting point is that three Mainland Chinese participants (CH1, CH7 & CH10) reported pronunciation check-up as a factor for dictionary consultation, however, none of Korean or Taiwanese participants reported this. Nonetheless, considering several other categories for reasons for dictionary use, country of origin did not appear to be a factor influencing any specific patterns in relation to dictionary consultation.

Some variance was noticed in terms of perceptions of types of dictionaries among the three groups. Many participants preferred a bilingual dictionary over a monolingual dictionary. Taiwanese participants (7 of 12) showed the strongest preference for a bilingual dictionary, while Koreans (4 of 10) showed least preference for this kind of dictionary. On the other hand, 4 Mainland Chinese and 4 Koreans showed a preference for a monolingual dictionary, whereas, 1 Taiwanese reported a preference for a monolingual dictionary. As for online versus electronic type of dictionary, no noticeable difference in term of their preferences emerged. Thus, with regards to type of dictionary preferred, country of origin once again did not appear to be a factor.

Looking across all of the categories within the context of country of origin, it appeared that it generally did not matter which country the participant originated from, an overall result that may not seem surprising since all three groups came from an Asian
country and thus shared certain cultural characteristics and perhaps thoughts and practices related to education.
CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

The previous chapter presented both the quantitative and qualitative findings of this study. This chapter will summarize and discuss the study’s findings as well as the conclusions arising from them. The summary and discussion will be guided by the study’s overarching research question (Does reading environment, computer-based and print-based, have any effects on L2 readers’ strategic behaviors with respect to unknown vocabulary?), and by its more focused research questions:

1. What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ level of lexical knowledge (advanced, intermediate, and low) in their strategic behavior toward unknown word meanings?

2. What are the differences/similarities of the effects of reading environment, computer-based and print-based, between L2 undergraduate students and graduate students in their strategic behavior toward unknown word meanings?
3. What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ country of origin in their strategic behavior toward unknown word meanings?

4. What are the L2 learners’ perceptions of their employing strategic behaviors (ignoring, inferencing, dictionary consultation, etc.) in dealing with unknown words in association with two different reading environments?

The main purpose of this study was to explore the effects of different reading environments—computer-based and print-based—pertaining to L2 learners’ strategic behavior when they are confronted with unknown words while reading English texts. In an effort to provide answers to the study’s overarching research question, the findings gained both from the quantitative and the qualitative portions of the study will be reviewed. Regarding research questions 1 through 3, the findings obtained mainly from the quantitative component, such as frequency of each strategy use employed by the participants, will be explored. For research question 4, on the other hand, the findings obtained from the qualitative component (individual follow-up interviews of the participants) will be examined.

Following the summary and discussion of the findings for each research question, the pedagogical implications and limitations of this study will be presented. Recommendations for further research pertaining to L2 learners’ strategic behaviors toward unknown words will then be provided. The chapter closes with concluding remarks that explore the contributions made by the study.
5.2 Summary of Findings

This study revealed that the learners, by and large, appeared to employ more strategies in the computer-based texts (CBT) than in print-based texts (PBT) environment; however, the difference between the two was not substantial. Although there was some difference depending on the reading environment, the most frequently employed strategies among the learners in both environments were the same: dictionary consultation followed by inferencing. On the other hand, the individual interview data showed that the picture was mixed, with some learners reporting that the reading environment did influence their use of strategic behavior toward unknown words, while others expressed the opposite point of view: the reading environment did not influence their strategic behavior.

It also showed that the effect of reading environment was more noticeable on the advanced group compared to the other two groups. The advanced group employed more strategies in CBT than in PBT. However, the effect of reading environment on the other two groups was almost negligible. In terms of the overall frequency of strategy use, the low group employed strategies far more frequently than the other two groups across the environments. In addition, pertaining to the types of strategy use, there seemed to be considerable effect of reading environment within each group.

In the meantime, graduate students seemed to be more influenced by the effects of reading environment compared to undergraduate students. The graduate students used strategies more frequently in CBT than in PBT. By contrast, the undergraduate students employed slightly more strategies in PBT than in CBT. Also, the graduate students
employed strategies more frequently than the undergraduate students in both reading environments. However, with regard to types of strategy use, undergraduate students seemed to be more influenced by the reading environment than the graduate students.

It is also indicated that the effects of reading environment appeared to exist among Mainland Chinese, Korean, and Taiwanese students. Both Mainland Chinese and Taiwanese students employed more strategies in CBT than PBT; Korean students, on the other hand, employed more strategies in PBT than CBT. Also, Taiwanese students employed strategies more frequently both in CBT and PBT compared to the two groups. With respect to the frequency of types of strategy use revealed complicated but, in part, clear effects of reading environment. For example, both Mainland Chinese and Korean students employed a dictionary far more frequently in CBT than in PBT. On the other hand, Taiwanese students used dictionaries far more frequently than Mainland Chinese and Korean students across the environments.

This study revealed that regardless of the participants’ level of vocabulary knowledge (advanced, intermediate, and low/rich and poor), their status (undergraduate and graduate students), and country of origin (Mainland Chinese, Korean, and Taiwanese), the participants showed strong preference for reading in PBT over CBT, especially when the reading is for academic purposes rather than for pleasure, such as newspapers or magazine. That is, although they used a computer every day, they believed that reading in PBT was more appropriate and appealing for their studies than CBT. A variety of reasons for their preference were reported: some of them were being more comfortable, easy, and efficient to read in PBT than in CBT.
The L2 learners’ perceptions of their strategic behavior across the environments showed contrasting views. That is, while some students indicated that they were influenced by the reading environment, others reported that reading purpose, such as reading for pleasure or reading for academic purposes, had a greater effect on their use of strategic behaviors rather than reading environment. Their responses also revealed that reasons for employing ignoring, inferencing or dictionary were similar, such as time limitations, (un)important words, reading purposes, or parts of speech although there is some variation. In addition, although there was some variance, many students, by and large, preferred bilingual dictionary over monolingual dictionary due to its convenience and familiarity of use.

5.3 Discussion

This section begins with the larger question that guided the study:

Overarching Research Question: Does reading environment, computer-based and print-based, have any effects on L2 readers’ strategic behavior with respect to unknown vocabulary?

The answers in terms of the overarching research question, the overall frequency of strategy use and types of strategy uses, seemed to support the findings of previous studies and the explanations accompanying them. Aust, Kelley, and Roby (1993) found that due to convenience of access to information through technology, learners in a hyper-reference group used twice as many definitions as those in a conventional print dictionary environment. They also found that in the computer-based environment,

\[\text{It is defined as an online electronic aid, such as an online dictionary.}\]
learners might look up the annotations even with words already familiar to them because the computer environment makes that so easy to do.

In addition, Chun and Plass (1997) suggested that “annotations in different modalities will often result in looking up a word more than once” (p. 188). They further indicated that L2 learners might access the multimedia annotations because of their interest in them rather than strictly for comprehension purposes. Thus, based on the previous studies, it seems not to be ill-presumed that learners in this study tended to employ more strategies in CBT than in PBT. The follow-up interview data in this study corroborated the above findings, and their explanations for their behavior within the computer-based environment were in line with the previous findings mentioned above. That is, students can copy unknown words while reading and paste them on the online dictionary, which saves more time than using either an electronic dictionary or a traditional paper dictionary, and thus was more appealing to them.

Although the findings of this research question revealed effects of reading environments, what needs to be mentioned here is the existence of occasional differences between participants’ quantitative and qualitative responses. It was sometimes the case that their quantitative and qualitative responses represented not only different but even conflicting views of their treatment of unknown words. While at first sight such differences might seem troubling, they also demonstrate the complexity involved in L2 learners’ handling of unknown vocabulary, and they offer support for the use of mixed methods of researching this topic. Without the use of both the quantitative and qualitative
measures, this study would have presented a less inclusive view of how these learners dealt with the unknown words they encountered in the two reading environments.

Research Question 1: What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ level of lexical knowledge (advanced, intermediate, and low) in their strategic behavior toward unknown word meanings?

The findings about the overall strategy use among the three groups seemed contrary to findings in the previous research. That is, Lo’s (2002) study showed that high proficiency language learners demonstrated a considerably higher frequency use of strategies than low proficiency language learners. However, the present study revealed contrary results to Lo’s study. The results of this may be explained by the likelihood that, as low level students, they would encounter more unknown words than the other students, which would presumably lead to more strategy use in order to better understand what was being read. This explanation holds up well when comparing the average number of strategies used between the advanced group and the low group, as described in the previous chapter.¹⁸

In addition, it was assumed that the low group learners, being in the low group, would have poor reading comprehension compared to the other groups. Thus, they made efforts to reach an appropriate level of reading comprehension by trying to figure out unknown words, which also caused them to use strategies more frequently. The two

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¹⁸ The frequency of strategy use for the advanced group was 9.8 in CBT and 7.8 for PBT; for the intermediate group, the average was 8.7 for CBT and 8.8 for PBT; on the other hand, on average, the lower group used strategies 15.1 times in CBT and 14.8 times in PBT.
explanations related to low group learners’ frequency of strategy use can be applied in reverse to the advanced group, that is, as advanced learners, they would encounter fewer unknown words and require less strategy use as a result.

In contrast, the fact that types of strategy use among three groups were influenced by reading environment seems to challenge, in part, the findings of previous research. In Lui’s study (1995), it was found that low-achievement learners tend to look up words in the dictionary in a hypermedia environment more than the intermediate- and advanced-achievement groups. However, the current study showed contradictory results. One possible explanation for this might be easy access to information on the computer, such as the online dictionary. That is, the advanced group did not seem to be hesitant to look up the unknown words in the dictionary in CBT.

Pertaining to the low group’s greater use of ignoring across the environments, one explanation is that low group learners might have had different aims or attitudes toward their reading performance. As long as they could generate either general ideas or main ideas instead of reaching a full degree of comprehension of the text, they did not seem to care much about their reading performance or reading environment. They seemed “more inclined to come up with a make-do interpretation that will enable them to keep reading” (Mackey, 1997, p. 454), which might cause them to employ ignoring far more than the advanced group regardless of reading environment. Because of the temporal pressure of the need to progress, they often tended to rely on making good-enough decisions without having a clear understanding of every detail of the text.
This group’s use of ignoring is interesting in an entirely different vein as well. Their use of ignoring raises important issues about the nature of ignoring itself. Ignoring, in this context, means to not attempt to define an unknown word, at least temporarily, and a question arises as to whether not treating something can be called a strategic behavior. All of the other strategies examined in this study involved taking an action to find information, whether it was consulting a dictionary, building inferences, and so on. Ignoring, in a sense, moves in the opposite direction. Indeed, it could be seen as an avoidance strategy, not a productive one. Thus, the results pertaining to the lower level group are perhaps misleading depending on how ignoring is conceptualized as a form of strategic behavior and what their reasons were for choosing ignoring. If ignoring is seen as a type of avoidance in which students have essentially given up on certain words and have no intentions of trying to understand them, the lower level group was then less active in treating unknown words than was suggested earlier.

Research Question 2: What are the differences/similarities of the effects of reading environment, computer-based and print-based, between L2 undergraduate students and graduate students in their strategic behavior toward unknown word meanings?

Reasons for graduate students’ more frequent strategy use in both environments cannot be attributed to their level of lexical knowledge, given that the average scores of the VLT between the graduate and undergraduate students were the same. In light of this, one possible explanation for the differences between the groups and the two reading environments might be differences in the learners’ study habits. It seems safe to assume

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19 Both undergraduate and graduate students’ average VLT score was 90 out of 120, or 75%.
that by and large the reading load for undergraduate students was not as extensive as that for graduate students. Thus, they might not have been as strategic in their reading as graduate students, resulting in less frequent use of strategies across the environments.

Another possible explanation might be that undergraduate students appeared to read textbooks more than journal articles compared to graduate students. While undergraduate students read textbooks mainly for tests, graduate students read academic journals, by and large, for writing a paper for the course that might require more in-depth understanding of reading materials. Thus, it might be addressed that the differences between the undergraduate and graduate students in terms of frequency of strategy use, along with types of specific strategy use in both reading environments, were due to this different text type, goal of reading, or motivation of the study.

Likewise, these explanations might also reveal more effects of the reading environments on undergraduate students, especially in terms of employing dictionary consultation and inferencing across environments. It is possible that the undergraduate students might have had different purposes of reading or motivation for reading compared to the graduate students, and so they might have demonstrated less consistent use of strategies across environments. That is, they might have been less willing to use a dictionary in PBT, in which an online dictionary was not available, resulting in more use of inferencing than a dictionary. This explanation might be further supported by the fact that the undergraduate students used a dictionary far more frequently than inferencing in CBT, in which they could have used an online dictionary. Although the difference was almost negligible, any potential reasons for undergraduate students’ employing more
strategies in PBT and in CBT appeared to be intriguing but complex. Thus, through further investigation with more undergraduate students, more observable patterns might emerged.

**Research Question 3:** What are the differences/similarities of the effects of reading environment, computer-based and print-based, relative to L2 learners’ country of origin in their strategic behavior toward unknown word meanings?

Both Mainland Chinese and Taiwanese students’ overall frequency of strategy between the two reading environments, in part, can be explained from the very similar views to answer the overarching research question for this study- more strategy use in CBT than in PBT. That is, because of easy and convenient access to online dictionary in CBT, they showed a greater use of dictionary than in PBT, especially for Mainland Chinese students. However, there were effects of reading environments on Korean students, the reasons for their employing more frequent use of strategies in PBT than in CBT per se seem to be very complex. More specifically, none of the analysis in this study except for undergraduate students’ overall frequency of strategy use revealed the pattern of Korean students’ strategy use. Furthermore, the difference was considerably greater than that of undergraduate students. Thus, without further investigation with more Korean students, it is difficult to explain why this pattern emerged.

In addition, reasons for Taiwanese students’ most frequent use of strategies might be, in part, attributed to individual differences. This is probably because of the fact that although Korean students obtained a little higher score in VLT compared to the other two
groups, both Mainland Chinese and Taiwanese students’ VLT scores\(^{20}\) were almost the same. This explanation might be further supported by the fact that several Taiwanese students looked up almost every single unknown word in the dictionary while reading, which was not the case for the other students within and among groups.

Nonetheless, Taiwanese students’ greater use of a dictionary across environments might be, in part, explained by their level of lexical knowledge. Although the differences in their level of lexical knowledge among three groups (Mainland Chinese, Korean, and Taiwanese students) were almost negligible as stated earlier, their VLT scores revealed that there were fewer Taiwanese students who belonged to the intermediate group compared to the other two groups. Most of them belonged either to the advanced or low group. That is, there seemed to be a wide variance in terms of level of lexical knowledge among Taiwanese students. Thus, in part, due to individual differences or possibly to low levels of lexical knowledge, Taiwanese students might have employed a dictionary far more than the other two groups, especially in PBT.

In terms of Mainland Chinese students’ specific types of strategy use, a possible explanation for more use of ignoring across the environments, compared to the other two groups (Korean and Taiwanese students) might be related to the their field of study. That is, in this study half of the Mainland Chinese students’ major was closely related to business or accounting, which requires less language skills than in the field of the social behavioral science. Thus, while studying materials, they might not have needed to pay a greater amount of attention to unknown words while working with their study materials.

\(^{20}\) Chinese students’ average VLT score was 89.7 out of 120, or 75%; Taiwanese students’ average VLT score was 89.4, or 74%; and Korean students’ average VLT score was 93.4, or 77.5%.
which was further supported by the interview data. More specifically, some of the
participants, whose major was relevant to business or accounting, reported that what they
usually studied was more numerically based or about case studies of experiences in
careers.

Likewise, the probable explanations above could also partially be explained by
their more frequent use of inferencing in PBT than in CBT. That is, in that their field of
study seemed to require less linguistic knowledge, they might have been reluctant to use
a dictionary and be more inclined to use an inferencing strategy instead in PBT compared
to CBT. It could be that they simply did not want to make the effort to find and consult a
dictionary, or they found it inconvenient to use a dictionary in PBT.

Research Question 4: What are the L2 learners’ perceptions of their employing strategic
behaviors (ignoring, inferencing, dictionary consultation, etc.) in dealing with unknown
words in association with two different reading environments?

The answers to the perceptions of different reading environments both challenged
and supported findings of previous studies, inasmuch as several studies have addressed
L2 learners’ conflicting views on multimedia learning environment (Ayres, 2002; Lim &
Schen, 2006; Son, 2007). However, more importantly, this study showed that reading
purposes played a decisive role in the participants’ preference for reading environment,
either PBT or CBT although there was some variation. In light of this, the answer for the
participants’ attitudes toward reading environment is in line with a recent study (Chou,
2009), which reported L2 learners’ low preference for reading academic texts on a
computer screen.
Similarly, this study’s results also suggest that reading purposes in association with reading comprehension can play a critical role in learners’ perceptions of employing certain types of strategies. In addition, the learners at least seemed to have their own beliefs in deciding which words they needed to pay more attention to, and which strategies they needed to employ. However, their decision might not be always on the right track, and the beliefs might vary among learners. Moreover, this study in part showed contrasting results with respect to the idea that guessing the meaning of unknown words is the most frequently used strategy among L2 learners (Fan, 2003). In this study, except for a couple of instances, dictionary consultation was the most predominant strategy among the learners.

Answers with regard to guessing the meaning of unknown words in part challenge some claims of the previous research. It has been pointed out that L2 learners, specifically, Chinese and Korean ESL learners, demonstrate mainly a top-down approach in which they rely on guessing the meaning of unknown words from context (Qian, 2004). However, the findings of this study revealed that L2 learners employ not only a top-down but also a bottom-up approach (utilizing morphological cues, syntagmatic cues, or sentence grammar) regardless of their level of lexical knowledge. One thing to bear in mind in this study is that once the learners decided to guess unknown words, they seemed to make every effort to figure out the meanings of unknown words by utilizing all sources and knowledge available to them.

With regard to types of dictionary use (bilingual or monolingual dictionary), a probable answer for their preference for a bilingual dictionary might be due to their
previous learning experience in their home country. It was assumed that most of the learners had years of experience using bilingual dictionaries and therefore felt more comfortable to use them. Another explanation might be because of the learners’ lack of vocabulary knowledge, inasmuch as using a monolingual dictionary seems to require rich vocabulary knowledge to understand explanations or definitions of words. Pertaining to preference either for electronic dictionary or online dictionary, the findings suggest that “different people have different dictionary lookup patterns” (Laufer & Hill, 2000, p. 16). That is, although some learners reported a strong preference either for online or electronic dictionary, many of them did not seem to be influenced by types of dictionary as long as they could get some help from a dictionary.

5.4 Conclusions

The findings of this study suggest that effects of reading environment, computer-based and print-based, on L2 learners’ behavior toward unknown words appear to be due to easy access to information through technology, in particular the Internet. Also, to compensate for their lack of lexical knowledge, low level learners tended to employ strategies more frequently across the environments, compared to high level learners. In addition, low level learners’ far more frequent use of ignoring might be related to good-enough decision-making. That is, because of the temporal pressure of the need to progress while reading, they often tended to rely on making good-enough decisions without having a clear and full understanding of every detail of the text. In addition, learners’ field of study might explain their preference for employing ignoring more frequently across environments. Study habits, text type, and goal of reading might result
in differences between undergraduate and graduate students’ frequency and types of specific strategy use in both environments. Lastly, L2 learners’ individual differences might also contribute to employing types of strategy use across the reading environments.

5.5 Pedagogical Implications

The findings of this study suggest several valuable pedagogical implications for instructors. In this section, the implications are mainly derived from observations and the follow-up interview data, and the implications also include reading environment, vocabulary knowledge, lexical processing strategy, and reading strategy in relation to, by and large, how to improve students’ vocabulary knowledge, reading comprehension, and language skills.

Considering difficulties, inconvenience, or problems of reading computer-based reading material, instructors need to train their learners to acquire techniques for reading multimedia reading environments. That is, they need to teach their students reading skills: skim, scan, extensive or intensive reading skills in both computer-based and print-based environments. In so doing, students can feel comfortable with reading in both environments, and they can result in similar reading performances across the environments. In addition, instructors need to help students become aware of the advantages of CBT: the CBT environment can provide several benefits for readers, such as fast and easy access to the online dictionary for locating unknown words and more information regarding background knowledge through the Internet, which might foster reading performance and vocabulary knowledge.
As a way of taking a finding into account (L2 learners’ most preferred lexical processing strategy is consulting a dictionary), instructors need to encourage their students to use a dictionary upon encountering unknown words. Students at least can gain some benefits from consulting a dictionary, such as better reading comprehension and vocabulary learning (Fraser, 1999b; Laufer, 2000; Luppescu & Day, 1993). In addition, it is also recommended for teachers to teach students, especially low level students, to use a dictionary more efficiently, for example, special features of dictionaries, how to cross-check meanings by using synonyms, and how to use the grammatical information in a dictionary, plus spelling rules.

In association with consulting a dictionary, the findings suggested students’ difficulty with polysemantic words (Van Parreren & Schouten-Van Parreren, 1981) due to a strong tendency to stick to one meaning, usually the primary meaning, of a word. Thus, instructors need to pay more attention to teaching polysemantic words. That is, teachers need to place an emphasis on improving students’ depth of vocabulary knowledge, in tandem with breadth of vocabulary knowledge which results in improving the students’ overall vocabulary knowledge, reading comprehension, and language skills in the long run.

Another implication is related to the problem of pseudofamiliar words (Laufer, 1997; Parry, 1991). Several students either misread or misrecognized some words that appeared to be similar to words they already knew, and thus they believed that they already had the correct meaning of those words. Accordingly, by being aware of these problems that some L2 learners have, instructors need to teach spelling more explicitly to
their students by highlighting confusing words or spellings, especially for low level learners. In addition, teachers also need to encourage students to consult a dictionary for pseudofamiliar words. In so doing, the learners can improve their vocabulary knowledge.

Furthermore, given the usefulness of affixes (suffixes or prefixes), easy inferencing word meanings, and easy and fast learning of vocabulary, teaching main affixes to students can be recommended. On the one hand, it is claimed that learning associated words together can make learning more difficult (Nation, 2001; Read, 2000); however, the participants in this study reported that learning vocabulary with similar words groups of words was very helpful to improve their vocabulary knowledge. Thus, teachers also need to keep the benefits and drawbacks of this approach in mind in teaching vocabulary.

There was a tendency for some students to ignore unknown words that were important for full comprehension, especially among low proficiency students. Some of them even were not aware of whether they knew about some words, resulting in ignoring most of them. In light of this, as a way of enhancing the low level students’ awareness of unfamiliar words, teachers can adopt pre-reading activities, through which the students can be introduced to some important vocabulary and challenging vocabulary as well.

It was found that the majority of the students tended to ignore meanings of adverbs while reading. Given that adverbs can be critical for full comprehension, instructors need to help learners to be aware of the importance of adverbial words. Indeed, this needs to be emphasized for L2 learners, in that verbs and adverbs are the most challenging for L2 learners to acquire (Reed, 2000).
Lastly, students reported that they read their reading materials more comprehensively and thoroughly depending on the reading purposes at hand, such as for a writing assignment. For example, the students tended to consult a dictionary more frequently to enhance their reading performance, directing them to pay more attention to important words and ignoring unknown words less often. Accordingly, as a way of improving students’ reading competence and vocabulary knowledge, teachers can link reading and writing through activities, such as summarizing, synthesizing, and responding.

5.6 Limitations of the Study

In an attempt to answer the research questions, the researcher employed both quantitative and the qualitative approaches, which can complement each other. Thus, this study could provide valuable, comprehensive, and insightful explanations of L2 learners’ strategic behaviors toward unknown words while reading English texts. However, this study has some limitations that need to be taken into account.

Given the relatively low number of participants (34) in this study, the overall results of this study gained through the quantitative approach might not be generalizable beyond these particular participants. In particular, the results based on the comparison of undergraduate and graduate participants are limited to these participants and their context. Also, the findings of this study might be limited due to the use of one expository reading passage for both the CBT and PBT environments. As a result, the study developed only a limited view of the students’ reading behaviors. It is possible that with other kinds of texts or other topics, they might have adopted different behaviors.
Similarly, depending on the features of unfamiliar words that the students reported, there might be some variation in relation to the students’ strategic behavior. The students might have demonstrated different behaviors according to whether the unfamiliar words were classified into low-frequency words or high-frequency words. For instance, if the text designed for this study had more low-frequency words than high-frequency words, the students might have employed another strategy in figuring out the meaning of unknown words. Consequently, in interpreting the findings of this study, the features and portions of unfamiliar words should be taken into account.

Although this study tried to minimize treatment effect between the two reading sessions (print-based and computer-based), there still might be treatment effect. This is mainly because of the intervals (2-3 weeks) between the two reading sessions and use of the same text. If there had been longer intervals between the two reading sessions, the number of unfamiliar words the students indicated and the use of strategy employed by the students could be different. Accordingly, the findings of this study are limited to comparisons of other students in similar treatment environments.

Also, the participants’ verbal reports might be another limitation of this study. The delayed retrospective think-aloud process (DRTA) was used for the verbal reports. In spite of the fact that most participants by and large were very good at describing their thoughts or behavior, some of them might not have been familiar with this procedure, which may have influenced their performance. In addition to this, some participants might not have showed their thoughts, opinions, or performance fully or accurately, in that they used the L2 (English) for their explanations. This concern can also be applied to
the follow-up interview process. For low (verbal) ability students, especially, the process might not optimize their capacity in delivering their views. Furthermore, the interview was carried out as only a one-time event. Repeated interviews with the same participants might have unearthed more concise findings, in-depth perspectives, and additional patterns about their attitudes and perspectives toward their strategic behaviors in tandem with the effect of the two different reading environments.

Since this study did not adopt any comprehension check-up measurement after students’ reading, the results of the study, especially pertaining to the participants’ frequency of use of specific strategic behaviors, might not be compared to any study that conducted a comprehension test. If the participants had known that there would be a comprehension test after reading, they might have adopted different attitudes or demonstrate different behaviors that might result in different findings.

In addition, the participants were divided into three groups (advanced, intermediate, and low) based on the results of their VLT scores. Given that there was wide variance among participants’ VLT scores, in association with some extreme scores in the low group, as described in the previous chapter (Chapter 4), the researcher had difficulty in determining cut-points to divide the groups. The variance was also present even within groups, especially the advanced and low groups. In particular, the wide variance among the participants might be more problematic due to a few extreme scores in the low group.

Lastly, given the participants’ country of origin, (Mainland Chinese, Japanese, Korean, and Taiwanese), the findings of this study might be limited to comparisons to
others from non-European language backgrounds, specifically East Asian language backgrounds. Although this study produced valuable insights in relation to lexical process strategies in dealing with unknown words, the findings might not be generalizable to either non-native college L2 learners from other contexts or learners from European language backgrounds.

Given the limitations stated above, the findings of this study should be cautiously interpreted and applied to other studies.

5.7 Recommendations for Further Research

In light of the findings, pedagogical implications, and limitations of this study, several lines of further research emerged. Some of them are related to reading environments, and others are about lexical processing strategies. Above all, given the feature and content of this study’s reading material, which was not related to the participants’ disciplinary fields, it might be feasible to conduct research which develops the reading material that is closely related to students’ major field with two different types, both print-based and computer-based texts. A study designed in this way would reveal more valuable insights into learners’ behavior toward unknown words depending on different environments.

Another possible line of future research involves a topic touched up on briefly earlier: the complexity of the notion of ignoring as a form of strategic behavior. The fact this treatment of unknown words, which involves avoiding them, was more prevalent among the lower level group than the other two groups, raises questions about what ignoring actually represents and what it tells us about students’ strategic behavior. Future
research could investigate students’ use of ignoring by looking at what they actually have in mind when they choose to ignore unknown words, including whether this is a temporary or permanent act on their part.

Just as ignoring is a complex term, or strategy, that requires further investigation, the term “unknown words” might be problematic as well. As used in this study, the term implies words that were completely unknown to the students. However, there could actually be different degrees of not knowing words. Some words could, for example, be semi-known. That is, students may have a vague sense of what they mean, or even a fairly strong sense. There might even be a continuum representing the varying degrees to which a word is “known” or “unknown.” It would be helpful if future research could focus specifically on such a continuum and see how a word’s placement on the continuum affects students’ use of strategic behavior in decoding its meaning. It would be helpful to know, for example, if students expend more effort in trying to uncover the meaning of completely unknown words as compared to semi-known ones. Such research could have important implications for vocabulary instruction.

In terms of another lexical process strategy, this study implied that there seems to be a wide range of competence or self-assessment in pertaining to the participants’ ability to infer meanings of unknown words correctly, ranging from 30% to 80%. Thus, it would be valuable to investigate the relationship between learners’ competence and their probability of making correct inferences. The findings through this research can provide information about how much they can rely on their correct inferences, in tandem with awareness of their competence or self-assessments. In so doing, learners can improve
their lexical processing strategy, lexical knowledge, reading comprehension, and language skills as well.

As an expansion of vocabulary research, the researcher would suggest the need to explore how L2 learners figure out the meaning of idiomatic phrases, with which many participants had difficulty in decoding them. Most of the participants in this study failed to find the meaning and gave up figuring out their trying after getting lost several times. Thus, a study needs to be conducted on how L2 learners attempt to figure out the meaning of idiomatic phrases, and why they fail to find the meaning of even after consulting the dictionary. As a result, learners can get some help in dealing with idiomatic phrases.

Lastly, the reasons for Korean learners’ use of more strategies in PBT than in CBT can hardly be explained in this study. Thus, research needs to be carried out to unearth any possible grounds for this result with more Korean participants and more in-depth repeated follow-up interviews. Explaining whether the reasons might be due to learners’ level of lexical knowledge, L1 influence, or their previous learning experiences in Korea might shed light on future directions in teaching Korean L2 learners or other ESL and EFL learners.

5.8 Concluding Remarks

Through quantitative and qualitative methods, this study investigated the effects of reading environments (print-based and computer-based) on L2 learners’ strategic behaviors in dealing with unknown words while reading English texts, with a total of 34
participants (Chinese, Japanese, Korean, and Taiwanese). This study also explored L2 learners’ perceptions of or attitudes toward employing their strategic behaviors in tandem with two different reading environments.

Despite its limitations, this study has shed some light on (ESL) instructors and L2 learners’ awareness and understanding of strategic behaviors toward unknown words in two reading environments in several respects. Above all, most previous studies have investigated L2 learners’ strategy use either in a paper-based environment or in a computer-based environment. However, this study compared the L2 learners’ strategy use in both reading environments. Thus, through this study not only instructors but also L2 learners can develop a better, more comprehensive understanding of students’ reading challenges and experiences in these two dominant environments in educational settings. In particular, this study has provided a clearer picture of how L2 learners approach unknown words while reading online and in print and what differences as well as similarities occur as they move within and across these environments. Its combination of quantitative and qualitative data gathering methods made possible a more inclusive view of this situation than has been seen in previous research.
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APPENDIX A

The Vocabulary Levels Test

The Vocabulary Levels Test: Version 2

Student instruction sheet for the Levels Test

This is a vocabulary test. You must choose the right word to go with each meaning. Write the number of that word next to its meaning. Here is an example.

1 business
2 clock
3 horse
4 pencil
5 shoe
6 wall

____ part of a house
____ animal with four legs
____ something used for writing

Your answer in the following way.

1 business
2 clock
3 horse
4 pencil
5 shoe
6 wall

____ part of a house
____ animal with four legs
____ something used for writing

Some words are in the test to make it more difficult. You do not have to find a meaning for these words. In the example above, these words are business, clock and shoe.

If you have no idea about the meaning of a word, do not guess. But if you think you might know the meaning, then you should try to find the answer.
### The 3000 Word Level

<table>
<thead>
<tr>
<th>1. bull</th>
<th>1. muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. champion</td>
<td>formal and serious manner</td>
</tr>
<tr>
<td>2. counsel</td>
<td>advice</td>
</tr>
<tr>
<td>3. dignity</td>
<td>winner of a sporting event</td>
</tr>
<tr>
<td>3. factor</td>
<td>a place covered with grass</td>
</tr>
<tr>
<td>4. hell</td>
<td>building where valuable objects are shown</td>
</tr>
<tr>
<td>4. hen</td>
<td>female chicken</td>
</tr>
<tr>
<td>5. museum</td>
<td>5. lawn</td>
</tr>
<tr>
<td>6. solution</td>
<td>6. atmosphere</td>
</tr>
<tr>
<td>1. blanket</td>
<td>1. abandon</td>
</tr>
<tr>
<td>2. contest</td>
<td>2. dwell</td>
</tr>
<tr>
<td>3. generation</td>
<td>holiday</td>
</tr>
<tr>
<td>3. obliged</td>
<td>follow in order to catch</td>
</tr>
<tr>
<td>4. merit</td>
<td>wool covering used on beds</td>
</tr>
<tr>
<td>4. pursue</td>
<td>leave something permanently</td>
</tr>
<tr>
<td>5. plot</td>
<td>5. quote</td>
</tr>
<tr>
<td>6. vacation</td>
<td>6. resolve</td>
</tr>
</tbody>
</table>

| 1. comment | 1. assemble |
| 2. gown | long formal dress |
| 3. import | goods from a foreign country |
| 3. attach | stop doing something |
| 4. nerve | part of the body which carries feeling |
| 4. quit | cry out loudly in fear |
| 5. posture | 5. scream |
| 6. tradition | 6. toss |

| 1. pond | 1. drift |
| 2. angel | group of animals |
| 2. endure | suffer patiently |
| 3. frost | spirit who serves God |
| 3. grasp | join wool threads together |
| 4. herd | managing business and affairs |
| 4. hold firmly with your hands |
| 5. fort | 5. register |
| 6. administration | 6. tumble |
| 1. brilliant | 1. aware |
| 2. distinct | thin |
| 2. blank | usual |
| 3. magic | steady |
| 3. desperate | best or most important |
| 4. naked | without clothes |
| 4. normal | knowing what is happening |
| 5. slender | 5. striking |
| 6. stable | 6. supreme |

### The Academic Vocabulary

<table>
<thead>
<tr>
<th>1. area</th>
<th>1. adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. contract</td>
<td>written agreement</td>
</tr>
<tr>
<td>2. vehicle</td>
<td>end</td>
</tr>
<tr>
<td>3. definition</td>
<td>way of doing something</td>
</tr>
<tr>
<td>3. exploitation</td>
<td>machine used to move people or goods</td>
</tr>
<tr>
<td>4. evidence</td>
<td>reason for believing something is true</td>
</tr>
<tr>
<td>4. infrastructure</td>
<td>list of things to do at certain times</td>
</tr>
<tr>
<td>5. method</td>
<td>or is not true</td>
</tr>
<tr>
<td>5. termination</td>
<td>5. schedule</td>
</tr>
<tr>
<td>6. role</td>
<td>6. begin</td>
</tr>
<tr>
<td>1. debate</td>
<td>1. alter</td>
</tr>
<tr>
<td>2. exposure</td>
<td>2. coincide</td>
</tr>
<tr>
<td>3. integration</td>
<td>3. deny</td>
</tr>
<tr>
<td>4. opinion</td>
<td>4. describe clearly and exactly</td>
</tr>
<tr>
<td>4. option</td>
<td>4. devote</td>
</tr>
<tr>
<td>5. scheme</td>
<td>5. release</td>
</tr>
<tr>
<td>6. stability</td>
<td>6. specify</td>
</tr>
</tbody>
</table>

| 1. access | 1. correspond |
| 2. gender | male or female |
| 2. diminish | 2. make smaller |
| 3. psychology | study of the mind |
| 3. emerge | 3. estimate |
| 4. license | entrance or way in |
| 4. highlight | 4. give special attention to something |
| 5. orientation | 5. invoke |
| 6. implementation | 6. retain |

| 1. edition | 1. band |
| 2. accumulation | collecting things over time |
| 2. channel | 2. channel |
| 3. guarantee | promise to repair a broken product |
| 3. estimate | 3. estimate |
| 4. media | feeling a strong reason or need to do something |
| 4. identify | 4. identifying and naming a person or thing |
| 5. motivation | 5._mediate |
| 6. minimize | 6. minimize |

| 1. explicit | 1. abstract |
| 2. final | 2. adjacent |
| 3. negative | 3. neutral |
| 4. professional | 4. global |
| 4. professional | meaning ‘no’ or ‘not’ |
| 5. rigid | 5. controversial |
| 6. sale | 6. supplementary |
## The 5000 Word Level


| 1. eagerness 2. loan to buy a house 3. small stones mixed with sand 4. soldiers who fight from horses 5. speech given by a patient in 6. church |
|---|---|---|---|---|---|

1. chart 2. forge 3. mansion 4. outfit 5. sample 6. volunteer

| 1. small hill 2. day or night before a holiday 3. soldiers who fight from horses 4. place where metals are made and shaped 5. think about deeply 6. bring back to health |
|---|---|---|---|---|---|

1. revive 2. extract 3. throw 4. bring back to health 5. provoke 6. contemplate

1. chatter 2. embarrass 3. heave 4. obscure 5. demonstrate 6. relax

| 1. have a rest 2. break suddenly into small pieces 3. make someone feel shy or nervous 4. speech given by a patient in 5. church |
|---|---|---|---|---|

1. decency 2. frail 3. harsh 4. incredible 5. municipal 6. specific

1. adequate 2. internal 3. mature 4. profound 5. solitary 6. tragic

## The 10000 Word Level

1. alabaster 2. tentacle 3. dogma 4. leg 5. rap 6. chandelier

| 1. small barrel 2. soft white stone 3. tool for shaping wood 4. cloth with a pattern or gold or silver thread |
|---|---|---|---|

1. throttle 2. convey 3. lien 4. octane 5. stint 6. beneficence

| 1. middle class people 2. row or level of something 3. cloth with a pattern or gold or silver thread 4. medicine to put on wounds 5. medicine to put on wounds |
|---|---|---|---|---|

1. scrawl 2. engrave 3. immure 4. perch 5. contaminate 6. rely

| 1. priest 2. release from prison early 3. medicine to put on wounds 4. medicine to put on wounds |
|---|---|---|---|

1. blurt 2. humble 3. mammoth 4. thick 5. strang 6. swagger

| 1. light fooling talk 2. a rank of British nobility 3. picture made of small pieces of glass or stone 4. picture made of small pieces of glass or stone |
|---|---|---|---|

1. illicit 2. lewd 3. against the law 4. thick 5. temporal 6. vindictive

| 1. steal 2. scatter or vanish 3. twist the body about 4. uncomfortable |
|---|---|---|---|

1. indolent 2. nocturnal 3. obsolete 4. no longer used 5. translucent 6. sly
APPENDIX B

Background Information Questionnaire

1. Name: __________________________ / e-mail: __________________________


3. Sex: _______ Male  _______ Female

4. Nationality: ________________________________

5. Major: ________________________________

6. Degree you are pursuing: _______ BA  _______ MA  _______ Ph. D.

7. Number of years you have studied English ________________ years

8. Number of years you have lived in the U.S. ________________ years

9. Number of years you have studied in the U.S. ________________ years

10. Number of hours you use a computer each week ________________ hours

11. What do you usually do when you encounter unknown words while reading in English?
    - ignore it _______
    - look it up a dictionary _______
    - guess the meaning _______
    - ask someone for help _______
    - other? (please specify) ____________________________________________________

12. Would you be interested in participate in the follow-up study (reading session and interview session)? Yes _______  No _______
APPENDIX C

How to Cool a Planet

- William J. Broad –

In the past few decades, scientists have come up with big, futuristic ways to fight global warming: Build sunshades in orbit to cool the planet. Tinker with clouds to make them reflect more sunlight back into space. Their proposals were relegated to the fringes of climate science. Few government agencies would pay for feasibility studies. Environmentalists and mainstream scientists said the focus should be on reducing greenhouse gases and preventing global warming in the first place.

Some of the world’s most prominent scientists say the proposals deserve a serious look because of growing concerns about global warming. Worried about a potential planetary crisis, these leaders are calling on governments and scientific groups to study exotic ways to reduce global warming, seeing them as possible fallback positions if the planet eventually needs a dose of emergency cooling.

The plans and proposed studies are part of a controversial field known as geoengineering* which means rearranging the earth's environment on a large scale to suit human needs and promote habitability. Dr. Cicerone, an atmospheric chemist,* emphasized that most scientists thought curbing greenhouse gases should be the top priority. Geoengineering* is no magic bullet. He said, “But done correctly, it will act like an insurance policy if the world one day faces a crisis of overheating, with repercussions. A lot of us have been saying we don't like the idea of geoengineering.”* But he added, “We need to think about it and learn, among other things, how to distinguish sound proposals from ones that are ineffectual or dangerous.

Many scientists still deride geoengineering* as an irresponsible dream with more risks and potential bad side effects than benefits; they call its extreme remedies a good reason to redouble
efforts at reducing heat-trapping gases like carbon dioxide.* And skeptics of human-induced global warming dismiss geoengineering* as a costly effort to battle a mirage. Even so, many analysts say the prominence of its new advocates is giving the field greater visibility and credibility and adding to the likelihood that global leaders may one day consider taking such emergency steps.

Critics of geoengineering* argued that it made more sense to avoid global warming than to gamble on risky fixes. They called for reducing energy use, developing alternative sources of power and curbing greenhouse gases. But international efforts like the Kyoto Protocol have so far failed to diminish the threat.

Geoengineering’s* advocates say humankind is already vastly altering the global environment and simply needs to do so more intelligently. Dr. Crutzen, the Nobel laureate from the Max Planck Institute, has drawn fire for his paper about injecting sulfur* into the earth’s atmosphere. The plan called for fighting one kind of pollution (excess greenhouse gases like carbon dioxide*) with another (sulfur dioxide*), though it appeared that any increase in sulfur* at the earth’s surface would be small compared with the tons already being emitted from the smokestacks of coal-fueled plants. Dr. Crutzen said, "Climatic engineering, such as presented here, is the only option available to rapidly reduce temperature rises." If international efforts fail to curb greenhouse gases, Dr. Crutzen added, "So far, there is little reason to be optimistic."

Words: 523

Source: The New York Times (June 27, 2006)
* geoengineering: attempts to deal with the effects of climate change produced by human activities

* atmospheric chemist: a chemist who seeks the causes of problems of acid rain and global warming

* carbon dioxide: CO₂; the gas produced when animals and people breathe out; produced by primarily through the burning of coal, oil, and gas

* sulfur: an element that is usually a light yellow powder and is used in drugs and industry

* sulfur dioxide: a colourless, pungent-smelling, toxic gas produced in the burning of fossil fuels and other sulfur-containing compounds
APPENDIX D

Checklist
Name: ___________________________                    ID: AAA_____________

Computer-Based Text / Print-Based Text                     Date: ________________

Strategies Used

<table>
<thead>
<tr>
<th>Strategies Used</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignoring</td>
<td></td>
</tr>
<tr>
<td>Inferencing</td>
<td></td>
</tr>
<tr>
<td>Dictionary</td>
<td></td>
</tr>
<tr>
<td>Etc.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

Delayed Retrospective Think-Aloud Process Interview

1. What happened when you read and came to a word you didn’t know?

2. Did you notice the words you didn’t know in your first reading or did you not notice them and continue reading?

3. You made a (long) pause at this point – do you remember what you were thinking about?

4. Why did you use the lexical processing strategy/strategies that you used?

5. What did you do after going to the dictionary/clicking the word?

6. What led you to suggest this meaning for the word?

7. Did you consider any other alternative strategies you did not mention?
APPENDIC F

Semi-Structured Interview

1. Can you describe any differences/similarities in the ways that you dealt with unknown words in the computer-based text and the print-based text?

2. Do you ignore unknown words? If yes, when and under what situations do you ignore them?

3. Do you infer or guess the meaning of unknown words? If yes, when and under what situations do you infer?

4. Do you use a dictionary? If yes, when and under what situations do you use it?

5. Can you describe your vocabulary learning experiences?
APPENDIX G
Letter of Recruitment

Dear International Students,

This letter is an invitation to participate in a research study. The research is part of a Ph. D. dissertation in the College of Education of the Ohio State University. The purpose of research is to investigate the effects of reading environment on L2 (Second Language) reading strategic behaviors toward unknown words.

This study will help us to better understand the strategic behaviors a reader employs when confronted with unknown words while reading an English text and may offer valuable insights and implications for second language reading, vocabulary learning, and vocabulary instruction.

If you agree to participate as a volunteer in this study, you will be expected to do the followings:

1. **Phase I**: Take a Vocabulary Levels Test to determine your level of lexical knowledge (30 minutes). You will also fill out a questionnaire for background information (10 minutes).

2. **Phase II (Two Sessions)**: Those who agree to participate in this phase will have an individual reading research session with the researcher to complete a Retrospective Think-Aloud process. This phase is composed of two sessions: In the first session, you will be given an English text (either the paper-based text or the computer-based text) to read. The type of the text in the first session, the paper-based or the computer-based text, will be randomly assigned. In the second session, you will read the other form of the text 2-3 weeks AFTER the first session. While reading, you will be asked to think-aloud (express) your thought process upon encountering unknown words. Each session will take no longer than 90 minutes and will be tape recorded.

3. **Phase III**: Those who agree to participate in this phase will be interviewed individually by the researcher. This semi-structured interview will last for about 60 minutes and will be tape recorded. You will be given **$10 per hour** for the participation in this study.

The results of the test, reading session, and the interview will be kept **strictly confidential**. When the sessions are completed, each participant’s name will be replaced by a code, and my dissertation committee and I will be the only people to have access to these records.

You will be free to withdraw from the study at any time without any penalty. If you agree to participate in this study, please contact me: __________________
APPENDIX H

Consent Form

I hereby agree that:

I am being invited to participate voluntarily in the study: *A Study of the Effects of Reading Environment on L2 Readers’ Strategic Behaviors Toward Unknown Words.*

I understand that all the information gathered for the study will be kept confidential and will be used only for research purposes. I am participating in the study anonymously, and my name will not be associated with this study, and that my records will be identified with a pseudonym.

I also understand that the reading session and the interview session will be tape recorded for research purposes. I am aware that I can withdraw from the study at any time without any penalty.

I acknowledge that I have been given an opportunity to obtain additional information and to ask any questions regarding the research.

This research has been reviewed and approved by the OSU Institutional Review Board (IRB) for the protection of human subjects.

Participant’s Name (please print): __________________________________________________

Signature: ___________________________ Date: ___________________________

Researcher’s Signature: ___________________________ Date: ___________________________
APPENDIX I

Descriptions of the Participants

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*Note. A (Advanced); I (Intermediate); L (low); U (Undergraduate); G (Graduate); CH (Mainland China); JP (Japan); KO (Korea); TA (Taiwan)*
## APPENDIX J

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# APPENDIX K

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## APPENDIX L

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APPENDIX M

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### APPENDIX N

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