Exploring Mandarin-speaking English-as-an-additional-language graduate students' academic reading strategies in three reading modes: Paper, e-reading without hypertext, and e-reading with embedded hypertext

by

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Bachelor of Arts, University of Victoria, 2011

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Supervisory Committee

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Abstract

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In the field of English-as-an-additional-language (EAL) reading, numerous studies have investigated EAL learners' employment of reading strategies, along with its potential relationships with other variables (e.g., language proficiency, major, and cultural background). The majority of existing findings have often failed to account for any internal processes or supplementary information about EAL strategic behaviour in academic reading.

This study investigated 26 Chinese EAL graduate students' reading strategy use across three reading modes and any relationships between EAL reading strategy use and task performance. Data included video recordings of participants' test performances, a post-task stimulated recall, and a post-task reading perception survey.

Results indicated that Chinese EAL graduate readers employed wide varieties of reading strategies, with cognitive strategies and social the most frequently and least frequently identified. Multivariate analysis showed statistically significant differences in strategy use within the cognitive category, indicating that EAL reading strategy use is complex, often employing several individual strategies at any time. Correlational analyses revealed no significant associations between overall strategy use and task performance. E-reading strategy use was positively correlated with task performances, but similar strategy employment on paper revealed dissimilar associations.

The main implication of this study is that EAL educators and researchers must be mindful that readers' perceptions may influence modality preference; however, modality preference may not positively influence EAL reading performance.

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List of Acronyms

EAL – English as an Additional language

ESL – English as a Second Language

EFL – English as a Foreign Language

L1 – First Language

L2 – Second Language

ONH – Online (no hypertext) reading group

HT – Online (with hypertext) reading group

E-reading – Electronic (or *online*) reading

IELTS™ - International English Language Testing System™

TOEFL iBT® - Teaching of English as a Foreign Language Internet-based Test

ETS - Educational Testing Service

LLS – Language Learning Strategies

SILL – Strategy Inventory for Language Learning

SORS – Survey of Reading Strategies

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Chapter 1: Introduction

Every year, international students prepare to attend English-speaking universities by taking exam preparation courses, performing high-stakes language proficiency assessments (and hopefully achieving the “magic score” for entry), and finally entering post-secondary education. Due to English being the unofficial language of commerce and the Internet, there is increasing pressure for new generations of students to be fluent in English in order to be more successful in their future careers.

The number of students coming to Canada to study has been increasing substantially for the last ten years, and the population of English-as-an-additional-language (EAL) students coming to study is overwhelmingly Chinese, accounting for 32.42% (n = 95,160) of the 293,505 international students enrolled in Canadian educational institutions. Statistics revealed that as of 2013, Chinese students were the leading demographic of all international students, with population increases of approximately 18% from 2012-2013, and an 84% overall increase from 2003-2013 (http://www.cbie.ca/about-ie/facts-and-figures/). Among the vast number of Chinese students currently in attendance at various post-secondary institutions, a substantial number of these are graduate students (Huang & Brown, 2009).

As the leading demographic of international students enrolled in English-speaking universities, Chinese students are of interest to researchers for a number of reasons. First, reading is arguably considered the most critical skill required for university success (Chou, 2009); therefore, any and all factors leading to positive task performance is important to be aware of. Secondly, academic English is a notably distinct language from

other Englishes with specific language needs often differing across languages and even language learning domains (Huang, 2013a). It has been further noted by recent studies that "reading skills… [is] an area deserving more attention, and can be applied across disciplines and levels of studies" (Huang, 2013a, p. 26).

However, current literature is lacking valuable information pertaining to EAL reading, particularly in the area of reading strategy use. The ability to read successfully in one's L2 (second language) is an invaluable contributor to academic success (Mirzaei, Domakani, & Heidari, 2014). Over the last 20 years, there have been a number of studies that have investigated EAL reading strategy use (e.g., Anderson, 1999; Brantmeier, 2002; Cohen, 2014; Nassaji, 2014; Urguhart & Weir, 2014), but the literature overwhelmingly tends to focus on English L1 reading strategies (e.g., Berg, Hoffman, & Dawson, 2010; Coiro, 2011), much to the detriment of EAL research. Moreover, the scant research available on EAL reading strategies tends to employ small sample sizes, examine only one mode of reading, employ only one kind of data collection instrument (e.g., inventories), and as a result, much of the recent findings cannot easily be generalized across different contexts.

Due to the largely internal nature of reading, it is critical that more in-depth steps be taken to identify and better understand graduate EAL reading strategy use, as there are many questions that need answering. A key question in current EAL reading strategy research is the extent to which there is a relationship between EAL reading strategy use and reading performance. To address this knowledge gap, this study aimed to investigate the observed and reported strategic behaviours of Mandarin-speaking EAL graduate students while they engaged in academic reading tasks, and to determine any

relationships between strategy use and performance in order to better understand EAL readers' unique educational needs while engaging in and completing academic reading tasks.

This thesis includes five chapters. Following the Introduction chapter, Chapter 2 provides an in-depth synthesis of current literature, including definitions of key terms, the role of L1 (i.e., first language) English in current research, the uniqueness of graduate EAL readers' language learning needs, the evolution of e-reading, and the significance of this study. Chapter 3 presents the methods used in this study, which includes outlining the three research questions, the research design, participants' characteristics, data collection instruments, data collection procedures, and data analysis procedures. I also present the coding schema used in the quantitative and qualitative analyses. Chapter 4 presents the results based on the collected data according to the three research questions and the qualitative analysis. Chapter 5 discusses the main findings of the study, including various implications related to EAL pedagogy. Chapter 5 also acknowledges the limitations of this study and provides some directions for future research.

Chapter 2: Literature Review

To investigate the nature of ESL readers' strategic behaviour while performing academic reading tasks, I have synthesized a range of literature on EAL reading, which includes key terms, the role of L1 English on EAL reading knowledge, EAL graduate language learner needs, a review of EAL reading research methods, and the evolution of e-reading.

2.1. The Realm of EAL Reading Strategy Behaviour

The following section discusses reading strategies as they stand in existing research.

2.1.1. Defining and Classifying Language Learning Strategies

Language learning strategies (LLS) have been studied since the mid-1970s, are seen as an integral component to understanding other aspects of strategic behaviour, and are a major area of research in the existing literature. Many researchers have proposed the categorization of language learning strategies, which is presented below.

Oxford and Crookall (1989) were the first to comprehensively synthesize the existing knowledge about language learner strategies, defining them as "the behaviours used by learners to move toward proficiency or competency in a second or foreign language… used in formal or academic environments" (p. 404), and categorize into a framework consisting of seven strategy categories: cognitive, memory, compensation, communication, metacognitive, affective, and social. This framework was later refined by Oxford (1990) and clustered into six strategy categories: memory, cognitive, compensation, metacognitive, affective, and social. Individual language learning strategies were then classified into these larger categories according to each strategy's

purpose(s). The categories were then defined based on the commonalities of each of the individual categories classified within. For instance, *memory* strategies connect new knowledge with existing knowledge in the process of learners' information storage and retrieval. *Cognitive* strategies involve direct manipulation of the language being used, to understand and produce the language. *Compensation* strategies facilitate L2 language use or production despite missing knowledge. *Metacognitive* strategies involve conscious planning, manipulating, or evaluating of effective learning. *Affective* strategies regulates affect (i.e., emotional and/or mental state(s)). Finally, *social* strategies involve interaction with self, or with others, for the purpose of improving learning.

Huang (2011) similarly lists six categories of strategies used in language learning, including *memory, cognitive, compensation, metacognitive, affective,* and *social*, and further breaks down strategy use into narrower, individual subcategories of strategies based on their purposes. *Memory strategies* involve "relating new material to existing knowledge in the process of storing and retrieving new information"; *cognitive strategies* involve "manipulating the target language to understand and produce language"; *compensation strategies* involve "using the target language despite missing knowledge; *metacognitive strategies* involve "consciously examining the learning process in order to organize, plan, and evaluate efficient ways of learning; *affective strategies* involve "self-talk or mental control over affect"; and *social strategies* involve "interacting with others to improve language learning" (Huang, 2011, pp. 7-8). This particular taxonomy was also adapted and put into use by a number of studies (e.g., Huang, 2010a, 2010b, 2013b; Swain et al., 2009) in EAL language learning and testing contexts, with focus given in particular to EAL speaking strategies.

While Oxford's and Huang's identified strategy categories are generalized to EAL language learning rather than exclusively to EAL reading comprehension, it is possible that these strategies could be related to EAL reading strategy use in reading in addition to general communicative competence. However, one should be aware that Oxford's language learning strategy framework is based on strategy use in general language learning contexts, which means that the target language being learned may not necessarily be taken into account. Huang's adapted framework, however, specifically focuses on EAL strategic behaviour in performance-specific tasks, which may facilitate greater strength when (and if) employed in EAL reading contexts.

2.1.2. Defining and Classifying Reading Strategies

There is some overlap in the groupings of individual strategies in EAL reading research (Akyel & Erçetin, 2009; Cohen, 2011; Huang, Chern, & Lin, 2009; Sheorey & Mokhtari, 2001). Individual strategies that share similar characteristics tend to be given broad, sweeping labels (e.g., *global, support*, which can be further broken down into more specific strategies such as attending, code switching, or monitoring affective state), or may be categorized under alternate strategy types in accordance with the research goals of the investigator (e.g., support strategies vis à vis metacognitive, compensatory, and affective strategies). Sheorey and Mokhtari (2001) identified three primary strategy categories that EAL readers use in reading comprehension tasks: *cognitive*, *metacognitive*, and *support*. *Cognitive strategies* are "deliberate actions readers take when comprehension problems develop" (p. 431); *metacognitive strategies* are "advanced planning and comprehension monitoring techniques" (p. 431); and *support strategies* are "the tools readers seek out to aid comprehension" (p. 431). Akyel and Erçetin (2009) only

included cognitive and metacognitive strategies as reading strategy categories in their literature; however, their definitions of the strategies significantly differed from that of Sheorey and Mokhtari (2001). Cognitive strategies, in this case, referred to strategies that "aid the reader in constructing meaning from the text" (p. 137) – a distinct difference, as the original definition implied some type of compensation in the event that comprehension fails, while the other sought to effectively construct an understanding of what was being read.

Huang, Chern, and Lin (2009) identified three different e-reading strategy types: *global (meta) strategies*, which "are intentional and carefully planned by learners to monitor their reading"; *problem-solving strategies (compensation)*, which "are the actions that readers employ while they are working directly with the text, especially when the text becomes difficult"; and *support strategies*, which, as mentioned previously, are tools used to aid comprehension (Huang et al., 2009, p. 14). These specialized labels seem to be broader versions of the same strategies, as discussed in Section 2.1.1.

However, given the breadth of reading strategy information presented above, it is evident that researchers may not be in agreement as to what strategies are nor what they encapsulate while in use by EAL readers; therefore, two individuals may not necessarily understand reading strategies the same way or how they should be defined, and may thus unintentionally operationalize them in different ways, leading to inconclusive results. Considering that reading is such a vast field of expertise, and is becoming exponentially larger with the recognition of multiple kinds of literacies present in reading today, this lack of consensus is a growing concern. A systematic definition of these terms is needed,

but may not be feasible until researchers have carefully described and operationalized the cognitive processes or strategies engaged by readers in different modes of reading.

For the purposes of this study, reading strategies are hereby operationalized as readers' conscious, goal-oriented thoughts, plans, and/or actions used during linear or nonlinear reading tasks, with the intent to comprehend what is being read and to purposefully direct this knowledge towards improvement of language knowledge and language use (as adapted from Cohen, 2011; Huang, 2011). These mental thoughts, plans, or actions are directed specifically towards academic reading materials or real-world reading materials, with the aim to (1) regulate cognitive processes in approach to and/or during the reading activity, or to repair knowledge in the event that comprehension fails while reading; and (2) consciously think, plan, evaluate, and execute actions during a given reading task with the intended goal of improving language comprehension, contextualizing new knowledge, and enhancing language use in reading and/or across communicative language domains.

2.1.3. "Strategies" vis-à-vis "Skills"

It is important to establish a clear operationalization of key terms when undertaking strategy research, as often the classifications of strategy types and the categorizations of individual strategies can greatly vary from one study to another. The importance of understanding the distinctions between "skills" and "strategies" cannot be overlooked. One must determine, however, where the "line" is when deciding what strategies and skills are; i.e., deciding which features uniquely distinguish strategic behaviour from skills, and deciding which features encompass the utilization of skills that set it apart from strategy use.

Strategies tend to be labelled as conscious, purposeful, goal-driven actions that are used in a deliberate way to achieve intended goal(s) (Afflerbach et al., 2008; Dörnyei, 2005; Huang, 2011; Manoli & Papadopoulou, 2012), or to solve a problem and/or compensate when comprehension fails (Block, 1986). These characteristics assist in distinguishing the use of strategies from general learning. Furthermore, strategy use is an active, learner-oriented process, requiring not only the selection of effective strategies, but to also "[monitor] the application of these strategies as well as the whole process of reading" (Verezub & Wang, 2008). There is no guarantee, however, that strategy use positively contributes to reading success, as the successful use of strategies in reading not only have to be intentional, but to also be used with control, accuracy, and precision (Afflerbach et al., 2008; Mirzaei et al., 2014; Plakans, 2009). Research has further shown that the ability to use strategies flexibly can aid in more successful L2 reading comprehension than those who only use strategies in a static way (Cohen & Macaro, 2007; O'Malley & Chamot, 1990, as cited in Mirzaei et al., 2014).

Skills, on the other hand, tend to be operationalized as strategies that have been mastered to the point of automaticity (Afflerbach et al., 2008; Williams & Moran, 1989), thereby used unconsciously to achieve a goal. Unlike strategies, skills are simply used without conscious consideration, and they are used in a manner conducive to reading success, not requiring the same kind of effort that strategies tend to employ (Manoli & Papadopoulou, 2012).

There is an ongoing debate surrounding the operationalization of LLS (i.e., language learner strategies) and the "difference between engaging in strategic learning and ordinary learning activities" (Dörnyei, 2005, as cited in Macaro, 2006, p. 322). Dörnyei,

in particular, criticizes strategy research due to the lack of empirical evidence distinguishing strategic learning from ordinary learning to the point of dismissing strategies as a present influence on EAL acquisition. I would postulate, however, that ordinary learning is comprised of both strategic learning and skills-based learning, where both work in combination with one another to acquire new knowledge.

2.1.4. Reading Strategies as Theorized under the Strategic Competence Model

EAL learners' strategy use is an integral component of communicative competence as proposed by Canale and Swain (1980) et al. (e.g., Bachman & Palmer, 1996; Canale, 1983; Chapelle, Grabe, & Berns, 1997; Douglas, 1997; Fulcher, 2003); furthermore, strategy use is an integral component in EAL reading, and is consciously employed to plan, evaluate, and/or achieve goals that readers set for themselves. The ability to use strategies effectively falls under Bachman and Palmer's 1996 model of strategic competence, which is described by Phakiti (2008) as "a general ability that enables an individual to use available resources by regulating online cognitive processes in accomplishing a communicative goal… [by] assessing the situation, setting goals, and planning what to do" (p. 238).

Because reading is one of the first elements taught in L2 learning, it must be approached purposefully through the development of specific tools aimed at understanding the written word, taking considerable effort and often spanning years for successful mastery (Grabe, 2006, as cited in Mirzaei et al., 2014). Strategic competence, unfortunately, does not easily allow for direct observation (Phakiti, 2008), and thus can create the potential for problems revolving around human fallibility; for example, inaccurate self-reporting of strategy use. However, it has been shown that EAL learners

of all levels employ a range of strategies while engaged in tasks (Cai, 2014; Guo, 2012; Phakiti, 2008), and regardless of the frequency of use, the appropriateness of use aids in determining reading success (Huang, 2013b; Macaro, 2006).

2.1.5. Reading Strategies vis-à-vis Language Learning Strategies

It is important to remember that, following the model of strategic competence as proposed by Bachman and Palmer (1996), both reading strategies and language learning strategies (LLS) would fall into one specific category under the realm of strategic competence. LLS is a broad spectrum of containing a wealth of strategy-related information pertinent to both competence and performance in EAL learning, and as such, much of the literature regarding either field of study tends to use similar (if not identical) instruments in order to uncover what kinds of strategies a) exist; and b) are used by EAL learners[1]. Unfortunately, this can be a problematic approach to conducting research, as without appropriate adaptation prior to application in research, these instruments' aims would be, more or less, to search for the same things over and over again, when LLS and reading strategies are not identical constructs. Reading strategy use is understood to be a specific area of linguistic knowledge containing unique properties within the sphere of LLS, but the two types of learning strategies are not necessarily complementary; i.e., LLS strategies may not share features similar to, or identical to, reading strategies. Previous studies have demonstrated relationships between competence and oral proficiency with regard to LLS use (Nakatani, 2006) as well as between speaking strategy use and task performance (Zhou, 2014); therefore, similar associations might also be found with reading strategy use and performance outcomes. This may be a potential reason that

[1] This would include determining to what frequency the strategies are used.

many of the instruments and taxonomies previously used for categorizing LLS have also been applied to reading strategies, and furthermore, why similar instruments tend to be applied both in investigating EAL learners' language learning strategies and the strategic behaviour of readers.

However, strategies use conscious, goal-oriented actions purposefully aimed at achieving comprehension goals (Huang, 2011). These actions may not necessarily overlap into related areas (e.g., speaking strategies, writing strategies, listening strategies); therefore, it is necessary that the breadth of available tools be adapted to meet the needs of those seeking to understand strategic behaviour specifically in the area of EAL reading. Using tools that aim to cover a broad area of language learning may not dig deeply enough to uncover critical data in specific domains of language learning, which means that critical information, and subsequently new knowledge, could be lost.

2.1.6. Reading Strategy Use by Comparing Multiple Reading Modes

The available research which compares paper-based and online reading, either with, or without hypertext incorporation, remains scant. Existing literature, at this point, tends to examine reading behaviour with less depth than current understanding requires, as shown in the following study.

Margolin, Driscoll, Toland, and Kegler (2013) examined reading behaviours mediated by paper, computer, and by e-reader (i.e., Amazon Kindle™), as revealed through multivariate, regression, and correlational analyses. Their aim was to identify any mismatches in reading comprehension when participants engaged in reading tasks using either paper, or e-reading technology closely resembling paper. What they found was that no significant differences were found in reading rates when text was read, either by

following the text with a finger, or using a mouse (p. 516). This indicated that the mode used for reading did not lead to any significant differences in reading comprehension among the participants; however, the researchers postulated that an older population might reveal different findings due to differences in familiarity with the technology, and potentially being “reluctant to use it or to try something new” (p. 517).

While this study shows promise in looking at reading comprehension differences among different kinds of reading modalities, one key limitation could benefit from a more in-depth study using EAL contexts. Margolin et al.’s study was conducted exclusively with L1 English participants. This presents a significant gap, as little (if any) existing EAL literature exists which investigates similar areas in the realm of reading behaviour, using similar variables and methods of statistical analysis. Although each reading modality used two different reading task types (i.e., narrative and expository) to gather information about reading comprehension differences among the three reading modes, there were two concerns with regards to the study’s methods. First, the data gathered about the participants’ reading behaviour was limited, with only 8 reading behaviours shown in the study’s findings. The existing literature in strategy research has shown that reading behaviour is a complex set of actions (e.g., Cai, 2014; Guo, 2012; Nassaji, 2014; Zhou, 2014). It is likely that such a restrictive scheme for identifying reading behaviour data has left out critical information, particularly since each behaviour identified was restricted to outward and observable actions. Meanwhile, much of the reading behaviour exhibited by participants is internal, which means that the findings here may not be generalizable, and also potentially misleading or incomplete.

Finally, hypertext was not a factor included in the scope of this study. While the study did make it clear that the aim of the investigation was to look specifically at paper, or paper-like reading modes to determine the extent to which there were discernible differences in reading comprehension among the modalities, hypertext is not a reading variable that should be ignored, particularly when e-reading devices were used in the investigation. The presence of hypertext is increasingly prevalent in online reading of all kinds. As a result, this study failed to acknowledge the potential implications of hypertext, even within its suggestions for future research. Neglecting to acknowledge, or to ignore the existence of hypertext in current research limits the potential for future research where hypertext may potentially be found to be an asset to reading comprehension.

2.2. Role of L1 English in Current Reading Literature

Much of the current literature investigating learners' reading strategy use, especially in the context of e-reading strategy use, is rooted in L1 English research (e.g., Naumann et al., 2007; Protopsaltis, 2008; Salmerón et al., 2005; Salmerón, Kintsch, & Cañas, 2006; Sutherland-Smith, 2002). While L1 English research has been critical to the development and growth of EAL research, the findings are limiting. EAL reading has been shown not to be a deficiently acquired version of L1 reading; it is a process with its own unique features (Fecteau, 1999; Huang, 2013a), up to and including physiological factors, such as eye movement (Bax, 2013). L1 reading research has contributed greatly to the areas of EAL language research and pedagogy, but with increasingly multilingual classrooms, there is a growing need for a more in-depth understanding of how L2 reading differs from

L1 reading, which means that more EAL studies are urgently needed to expand upon existing knowledge.

In the context of e-reading, much of the literature examining the use of e-reading strategies has been conducted using L1 English-speaking participants to the exclusion of EAL learners (e.g., Berg et. al, 2010; Margolin et al., 2013). This indicates a need to understand what the relationship is between EAL learners and their strategy use in e-reading, as current research in L1 English e-reading strategy use may not accurately reflect the strategy use of all EAL readers. Akyel and Erçetin (2009) mentioned in their findings the possibility that EAL readers may need to develop additional strategies for e-reading due to the visual contrast between traditional reading and e-reading, which further distinguishes EAL readers from L1 readers in terms of their unique needs.

Although advances have been made to address the limitations of studies on EAL reading comprehension through numerous qualitative and quantitative methods, current literature largely investigates traditional reading contexts and does not necessarily take other literacy modalities into account. While traditional reading largely consists of print on paper, e-reading often differs in terms of formatting, page layout, and colour. This modality may require specialized micro-level decoding strategies (e.g., adjusting to differences in font size, size of e-page, use of hypertext) that may not be necessary for EAL paper reading tasks (Mangen, Walgermo, & Brønnick, 2013).

Despite its acknowledged importance, EAL strategic behaviour is not sufficiently accounted for in the context of language use. Empirically substantiated research has noted the complex relationship between EAL learners' strategy use and their overall performance (Purpura, 1999; Swain et al., 2009), and the needs reported by students,

instructors, and researchers alike that EAL learners' cognitive processes involved in language production require further examination (Hill, 2011; Huang, 2010b). This examination includes the need to understand EAL learners' strategic behaviour in EAL reading contexts, especially to understand the difference in strategy use across a variety of modalities.

2.3. Language Learning Needs of Graduate Students

There are numerous studies that identify the language learning needs of undergraduate EAL students (Akyel & Erçetin, 2009; Amer, Al Barwani, & Ibrahim, 2010; Huang, Chern, & Lin, 2009; Park & Kim, 2011; Zaki, Hassan, & Razali, 2008); however, the literature on EAL *graduate* students' language learning needs remains scant in the area of reading strategy behaviour. It is important to acknowledge the language learning needs of graduate students in contrast to undergraduate students, as the strategies involved in reading comprehension may differ in their application depending on the graduate readers' education, and the purpose and goal of the material in which they are engaging.

Furthermore, EAL graduate students have specific language learning needs, particularly in the area of academia, which set them apart from undergraduate students. Such language learning needs include deep reading, critical thinking and review, and the ability to synthesize large amounts of academic literature. This makes it especially important not to integrate EAL graduate learners into one general language learning group, as both undergraduate and graduate students' perceived and assessed learning needs may in fact differ from one another (Huang, 2010b), leading to potential implications in the overall success of one's learning. As of now, it remains unclear as to

whether or not readers' strategic use is transferable to other modalities other than paper-based reading.

At present, many studies have demonstrated a general preference for reading to be conducted using paper books rather than by electronic means, particularly in academic contexts (Chou, 2009; de Oliveira, 2012). However, with the increasingly popular use of tablets as one of many tools used for electronic reading, and the onset of a new generation having been raised reading a multitude of both paper-based and electronic books, it is questionable to assume that the trend in preferring paper-based books may continue for upcoming generations of EAL readers. For instance, Bensoussan revealed in his 2009 study on multilingual readers that students' reading habits depended on what medium they were using to read. Newspapers were read primarily in the readers' L1, while the Internet was a medium that tended to be read in a variety of languages, and that readers' overall preferences were linked to the readers' interests, with English being a prevalent language used for reading "regardless of the reader's L1" (p. 476). While Bensoussan did not explicitly look at academic contexts, his findings indicate a growing need to examine multiple reading modes, to identify EAL readers' perceptions and preferences within the context of academic reading, and to discover to what extent these perceptions and preferences are associated with performance outcomes.

2.4. Review of Methods in Current EAL Strategy Literature

Over the past 20 years, a multitude of research has closely examined second language reading; however, only a select few of these investigations have looked specifically at EAL reading strategies and their relationship(s) to reading comprehension in academic contexts. The following sub-sections synthesize the most recent EAL reading strategy

research and the methods used in these studies, identifying strengths, limitations, and some of the research advances made based on the studies' findings.

2.4.1. Participants and Sample Sizes

There is a wide variety of participant samples and sample sizes that have been used in EAL reading strategy literature. Some studies have used limited sample sizes (e.g., Akyel & Erçetin, 2009; Chou, 2011; Park & Kim, 2011; Plakans, 2009); meanwhile other studies have been widely variant with regards to language and education backgrounds (Jarvis & Pastuszka, 2008; Sheorey & Mokhtari, 2001). This small sample size and variation in participant's background is a limitation which exists in current research, especially with regards to graduate students' strategic behaviour in reading contexts for two main reasons: (1) the findings are rarely generalizable beyond the scope of the research context; and (2) the variation of learner backgrounds presents the possibility of confounding variables that may not permit meaningful statistical analysis.

These limitations do not necessarily mean that the existing findings should be discredited. Each of the studies reveals findings which continue to build on the knowledge we have today. For instance, Akyel and Erçetin (2009) were able to expand on a previous study (i.e., Anderson, 1991), by identifying new processing strategies used by advanced EFL learners that were otherwise unaccounted for in previous literature. Furthermore, due in part to the meticulous, detail-oriented nature of strategy research, it is enormously time-consuming to observe, collect, and analyze strategy data. While larger sample sizes would generally be ideal for strengthening claims based on any findings, the field of EAL reading strategies would not have been able to evolve as quickly as it has without the contributions of smaller studies. Larger studies are often

developed and conducted based on the limitations and variables of existing studies; therefore, it would be unwise to ignore the findings simply because the sample size is limited. Furthermore, including variations of education backgrounds may facilitate future inquiries towards socio-cultural variation in terms of EAL strategy use.

2.4.2. Instruments

To date, there have been a number of instruments used in existing EAL strategy research, including strategy inventory lists such as SILL (e.g., Huang, 2010a) and SORS (e.g., Alhaqbani & Riazi, 2012; Alsheikh & Mokhtari, 2011; Amer et al., 2010; Huang & Nisbet, 2014; Iwai, 2009), and stimulated recall reports, conducted either concurrently (i.e., conducted at the same time as the task being performed) (e.g., Guo, 2012), or retrospectively (i.e., following a task) (e.g., Huang, 2013b). Non-standardized instruments have also been used as a means of gathering information about EAL reading processes (e.g., Akyel & Erçetin, 2009).

While existing research instruments can and do provide a wealth of information in the field of reading research, there are many criticisms that surround them and their implementation in EAL reading research, presented in the following sub-sections.

Questionnaires/Strategy Inventories. In reading research, a number of valuable instruments have been developed to uncover what kinds of strategies are being employed during a given reading task. Each instrument has its own strengths and limitations which are critical to be aware of when employing them in EAL language research, particularly within domain-specific contexts. These tools have been shown in the following sub-sections, with examples of instruments primarily found in recent reading research, particularly with reference to the domain of strategic behaviour used in reading research.

SILL. The Strategy Inventory of Language Learning (SILL), developed by Oxford (1990), was designed to measure students' language strategy use while engaged in tasks. Teachers and learners alike can use this instrument to report what strategies learners access while learning a language. SILL version 7.0 is currently the version used to measure EAL learners' strategic behaviours across language learning domains (Russell, 2010), which groups strategies into six distinct categories, aiding in organizing strategic behaviour according to the purposes for which it was employed. The versatility of this instrument in its employment across pedagogical contexts makes SILL a unique data collection instrument, as it facilitates opportunities for both instructors and learners to raise their awareness about the language strategies employed across tasks.

However, many criticisms exist. SILL has been criticized as being "too outdated," referring only to general language learning rather than to domain-specific learning (e.g., Huang, 2011), which potentially indicates that much of the inventory used to distinguish language learning strategies would likely be irrelevant when used in a domain-specific study. SILL is also accused of not being transferable across sociocultural domains (Macaro, 2006; Russell, 2010), and thus, any results may only be applicable to Western cultures, which would render the instrument invalid in cross-cultural contexts, and thus limit the qualitative value in EAL reading research.

Finally, in terms of empirical value, recent studies have shown there is little to suggest that using the SILL does, in reality, make EAL learners more aware of the strategies they use, particularly when it comes to why they use them (Russell, 2010). In terms of strategic behaviour, between human fallibility and the lack of calibration between teacher, researcher, and student ideas of what reading strategies are considered to be

and/or not be, the SILL is hardly a comprehensive tool by which reading strategies can be accurately measured, particularly since the SILL is designed with a broad conceptualization of what is to be accounted for (i.e., language learning strategies).

SORS. The Survey of Reading Strategies (SORS) was developed by Mokhtari and Sheorey (2001, 2002) as a method for post-secondary readers to identify which strategies they perceived themselves to be employing while engaged in a reading task, regardless of L1. At present, it is arguably the most widely used reading strategy inventory used in EAL reading research. With its foundation coming from the previously used MARSI (Metacognitive Awareness of Reading Strategies Inventory), SORS' aim is to raise learner awareness using a scoring system showing what learners believe themselves to be employed during reading (Mokhtari & Reichard, 2002).[2]

However, this instrument presents concerns on a number of levels, which are presented in the following points:

(1) Reporting scores only indicates what the readers believe themselves to be using, not what is actually being used, which indicates that the entire picture may not be captured in full using this instrument. Questionnaires cannot realistically represent a complete picture of every reading strategy used by every individual. Meanwhile, EAL readers may claim that they are using a particular strategy while engaged in the reading process; however, observable evidence may potentially refute the reported behavior.

(2) Reporting scores only indicates processes which EAL readers themselves believe that they are consciously aware of and purposefully paying attention to. EAL readers can often be unaware of, or neglect to report, strategies related to affective factors (e.g., how

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[2] Not to be confused with metacognitive strategies, which was discussed in Section 2.1.1.

readers manage anxiety during a test) or social factors (e.g., asking the interlocutor for help). This can occur due to the reader not necessarily being aware that a particular action was a reading strategy, or because previous strategy training (as is common for high-stakes language exam preparation) did not explicitly mention such behaviours to be considered a form of strategy use.

(3) In terms of concerns about capturing EAL strategic behaviour, the questionnaire does not distinguish e-reading strategies from hypertext-specific reading strategies. There is a lack of empirical evidence that would lead to an understanding of the strategies employed by EAL learners while reading material containing embedded hypertext, and the nature of the strategies used in relation to the existing operationalized definition of e-reading strategies (as presented in Section 2.5.).

(4) Finally, SORS is designed to be used on both native and non-native learners of English. This is a potential weakness of the instrument, however, as it assumes that both native and non-native students would employ similar strategies, and possibly even assumes that these strategies are commonly used, and can and/or do transfer across language and/or sociocultural boundaries. It is crucial to use tools that are specifically designed with EAL learners in mind, so that both their needs and their potential strategic behaviours are not lost during research investigations.

The Likert Scale. SORS employs a 5-point Likert Scale to determine which strategies learners are using when engaging in a reading task based on participants' usage ratings. The Likert Scale is a preference rating scale, typically ranging from 0-5 per question, and provides an accessible method for researchers and instructors to collect EAL strategy data, based on the responses that EAL readers provide.

While useful in garnering learners' perceptions of what strategies they believe to be using while engaged in reading tasks, the Likert Scale has been critiqued as not providing an accurate account of how EAL readers use the strategies they know to comprehend reading material when they are engaged in a given task. The self-report data elicited through this type of instrument is not without serious limitations (e.g., Mokhtari & Reichard, 2004), as the use of a Likert Scale assumes that learners all interpret the scale the same way. Furthermore, the question about whether or not strategies elicited through questionnaires accurately reflect learners' actual strategic behaviours in relation to a specific task is also debatable, especially when the use of such an instrument does not match the theoretical basis of the research, or lead to the discovery of ways that one's research questions can be appropriately addressed (Huang, 2010a, 2012).

Think-Aloud. Think-aloud (TA) protocols are an invaluable source of information available to strategy researchers. TA affords the opportunity for research participants to elicit what they are thinking about when they perform a task, including how they are feeling, and any existing evaluations they have of their performance. Such valuable data coming directly from the participants has been used as a source of data in many EAL studies (e.g., Akyel & Erçetin, 2009; Berg et. al, 2010; Huang, 2014).

Using think-aloud as a primary research tool, the reliability of any findings may be met with a degree of scepticism, with some critics claiming that research participants, when subjected to stimulated recall, cannot possibly report every strategy utilized, nor every process undergone during participation (Burton, Shadholt, Rugg, & Hedge, 1990, as cited in Huang, 2014; Swain et al., 2009). Because of the concerns of report completeness accurately mirroring the thought processes of EAL learners (Egi, 2008, as cited in Huang,

2014), providing EAL learners with the option to report in their L1 may result in an increased depth of verbal report (Huang, 2014). Providing this option has proven useful in recent studies involving verbal stimulated recall reports (e.g., Guo, 2012).

An alternative option to maximize the utility of think-aloud tasks is to use other data collection instruments as primary sources, such as observation using video recordings of participants' performances, and to utilize the think-aloud reports as a secondary instrument. This affords the opportunity for a fuller, more enriched picture of how individuals employ strategies when they are engaged in a task, as it gives a) the participant the opportunity to recall information that he or she may have otherwise missed; and b) it gives the researcher an opportunity to discover strategic behaviour being employed that the participant may not have recognized or acknowledged to be strategy use through observation, and c) to potentially cross-validate what has been observed to what the participants reports in their stimulated recall.

Non-standardized instrument implementation. In previously conducted studies (e.g., Akyel & Erçetin, 2009), the reading tasks employed in the data collection process may not necessarily be adopted from standardized academic materials, such as tests from high-stakes language testing authorities (e.g., IELTS™, TOEFL iBT®). Using instruments that have not been theoretically grounded or empirically validated limits the degree to which findings can accurately reflect participants' overall performance. There are potential issues including text misinterpretation, cultural subjectivity, unclear questioning, inappropriate language use for the proficiency level being examined, and more. By using standardized testing systems such as TOEFL iBT® or IELTS™, consistency, validity, and replicability can be enhanced and strengthened.

Unfortunately, there have not been many new “breakthroughs” in reading strategy research in recent years, which limits the possibility of unique discoveries being uncovered for two reasons: a) no other instruments appear to be being field-tested, validated, and/or implemented; and b) current instruments are not being used in varying methods at multiple points in time during research (Dörnyei, 2005). To change the purpose of an instruments’ use in research is to create greater possibilities for new discoveries to emerge. Ideally, new instruments should be developed, field-tested, and implemented for reading research with the intent of implementing innovative research techniques in order to garner a maximum amount of information through which analyses can be made.

2.5. The Evolution of Electronic Reading

In a world where reading electronically is quickly becoming a common practice, the lack of academic literature identifying the types of e-reading strategies required for real-world reading is a significant gap in knowledge, raising attention to the implications of this lack of knowledge on academic reading. To address this, the distinction between paper reading strategies and e-reading strategies must be made. For the purposes of this study, paper strategies are reading strategies which are employed while engaging in reading tasks on the paper modality, using the key operationalization found in Section 2.1.2. Meanwhile, e-reading strategies are reading strategies used exclusively for reading comprehension while using electronic modalities, such as laptops or tablets. These e-reading strategies can be broken down into two categories: with embedded hypertext, or without embedded hypertext.

To date, there has been little description on what students are expected to know and competently utilize while engaged in e-reading tasks, which indicates the likelihood that instructors have little education on strategic instruction paying specific attention to electronic reading, let alone hypertext. EAL learners are generally expected to be able to research and read online in order to fulfill the expectations of post-secondary education; however, the literature for instructors to access tends to be limited in terms of pedagogical application (Shapiro & Niederhauser, 2004). Meanwhile, there is a lack of research to what extent e-readers adopt paper-based reading strategies for comprehension purposes, nor to what extent e-reading calls for independent strategies of its own. One must then determine the following: (1) the relationship between these strategies in reading; (2) whether or not paper-based strategies and e-reading reading strategies are two distinct branches of cognitive reading behaviour with their own unique features, or if they share overlapping characteristics; and (3) if there are overlapping characteristics between paper and e-reading strategies, the extent to which these strategies are used in the same ways for the same intended purpose(s).

2.5.1. Hypertext-Based Strategies: Potential Distinctions

Hypertext is a relatively new aspect of reading, with studies going back to the early-1990's in terms of analyzing it for its perceived utility (e.g., Slatin, 1990). Related literature suggests that many factors contribute to the construction and comprehension of hypertext, including readers' beliefs, L1, and culture (Al-Seghayer, 2005). Hypertext is broadly defined by DeStefano and LeFevre (2007) as "a collection of documents containing links that allow readers to move from one chunk of text to another" (p. 1617). Hypertext can be found in many different forms, from embedded links, to pop-up boxes

that appear when the embedded link is clicked on by a mouse, to embedded audio and video files. EAL hypertext reading has used many of these formats, but the majority of recent research has focused on hypertext; i.e., embedded links, which can provide readers with a degree of freedom in selecting and organizing information.

At present, there is little research to consistently explain navigation in hypertext-based reading. The only research accounting for hypertext navigation structures seems to be by Shapiro and Niederhauser (2004), and Amadieu, Tricot, and Mariné (2009), who described two different types of hypertext navigation structures involved in hypertext-embedded e-reading. *Hierarchical hypertext* provides access only to superordinate and subordinate hyperlinks, resulting in limited amounts of links and restricted variations of hyperlink types in order to preserve an organized structure and a sequential selection of information. *Networked hypertext*, on the other hand, is semantics-based and connects related information, resulting in a larger amount of embedded links and greater variation in hyperlink types. This is an important consideration, considering the implications that different navigational pathways could have on EAL readers' cognitive workload. Previous research on hypertext has indicated that the strategies for reading hyperlinked text are not so different from reading printed materials (Akyel & Erçetin, 2009; Al-Seghayer, 2005), with Al-Seghayer suggesting EAL readers to be unanimously in favour of well-structured hypertext (i.e., providing more structural cues to decrease cognitive load) in contrast to less-structured hypertext (i.e., providing fewer or no structural cues to decrease cognitive load). These findings indicate that document organization might play a (currently) unspecified role in how EAL learners engage with reading tasks, which could have monumental implications for graduate EAL academic reading comprehension.

On the Internet, where a vast majority of available reading material is published in English, three types of hypertext links can be uniquely distinguished in the literature, hereby operationalized by the following three terms. (1) *Word-level* hypertext provides more specificity to the definition of a given word containing the embedded hyperlink (e.g., embedding *Oxford English Dictionary*'s definition of a particular word to domain-specific jargon). (2) *Concept-level* hypertext provides related information to the text's overall theme (e.g., embedding http://www.wikipedia.org/[-insertexamplehere-]) to an idea presented within the literature that may require more context. Finally, (3) *referential* hypertext acts as a method of academic citation, providing direct access to scholarly articles or online journals where this research is available in full (e.g., *The Guardian* digital newspaper).

Although Akyel and Erçetin found in their 2009 study of advanced EFL learners that most of the strategic behaviour identified in the reading task "were similar to those used in printed texts" (p. 146), the researchers also noted a lack of transference between some strategies used in paper reading and hypertext processing, which suggests that hypertext reading may have its own specialized strategies. Chou (2009), on the other hand, found that in academic reading tasks, the participants generally preferred to engage in their tasks using paper. In contrast, reading for pleasure tended to be done using e-reading modalities. Furthermore, Chou's findings indicated that unless directly related to the text, that hypertext tended not to be employed by EAL graduate students during academic task performance, as it was considered too disruptive. The perception of Chou's participants towards the use of hypertext in academic reading tasks warrants further investigation,

particularly due to the possibility that hypertext may have its own unique cluster of strategies for successful EAL comprehension.

Recent studies have also discovered that readers' preferences in reading media and their overall comprehension performance may be mismatched (Universität Mainz, 2011). If this is true, should high-stakes testing such as IELTS™ and TOEFL iBT® not be converting their assessment into a format that is equivalent in functionality to what the world is quickly encompassing as the new norm for reading purposes? Hypertext has the potential to provide a freedom in reading tasks that allows the reader to control reading order (McNabb, 2006; Salmerón, Kintsch, & Cañas, 2006; Shapiro & Niederhauser, 2004); meanwhile, language assessments such as IELTS™ and TOEFL iBT® continue to maintain a rigid, inflexible structure to their texts, include no hypertext, and give test developers full control of reading order. That said, the amount of academic information available about the extent to which students access and interpret information embedded within hypertext is, at best, limited.

As a result, it should come as little surprise that EAL readers' perceptions and uses of e-reading strategies must be carefully examined. The incorporation of hypertext into everyday e-reading has revolutionized reading through technological media, but the vast majority of reading research remains "tight-lipped" as to whether or not hypertext, in fact, facilitates strategic behaviour in EAL reading comprehension tasks. This demonstrates a notable gap in high-stakes language tests, considering that their original purpose is to ensure that EAL students are adequately prepared for functioning in the English world.

The intent of this empirical study is to identify and examine what strategies EAL learners use to understand electronic text, with and without incorporating embedded hypertext, and paper-based text in English academic reading comprehension tasks, and to investigate the relationship between the strategies used and reading performance. The investigation into the strategic behaviour of readers using three different forms of reading media is designed to reveal whether their cognitive processes, as examined by their strategic behaviour, vary according to what mode of reading is being used, and to what extent these processes more efficiently facilitate successful reading comprehension.

Chapter 3: Methods

3.1. Research Questions

This study explored EAL readers' strategy use across three reading modes and their relationship(s) to academic reading performance, using the following three research questions:

1. What are the reading strategies reported by EAL learners who use paper-based materials, EAL learners who use e-reading materials without hypertext, and EAL learners who use e-reading materials containing hypertext?
2. What are the differences in the reading strategies among the three groups?
3. What are the relationships in the reported reading strategy use among EAL readers and their reading performance?

3.2. Research Design

The study involved three groups of L1 Mandarin, EAL graduate students in British Columbia, Canada, with 9 participants in two groups, and 8 participants in the third group for a total of 26 participants[3]. Groups A, B, and C performed a section of the IELTS reading test in a simulated testing context. Each group underwent the same procedures under identical environmental conditions over the course of two sessions, with the second session being performed one week after the first session. Figure 1 below shows the study's overall design.

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[3] Due to one participant failing to appear for session two, only 8 participants in the paper group completed the study.

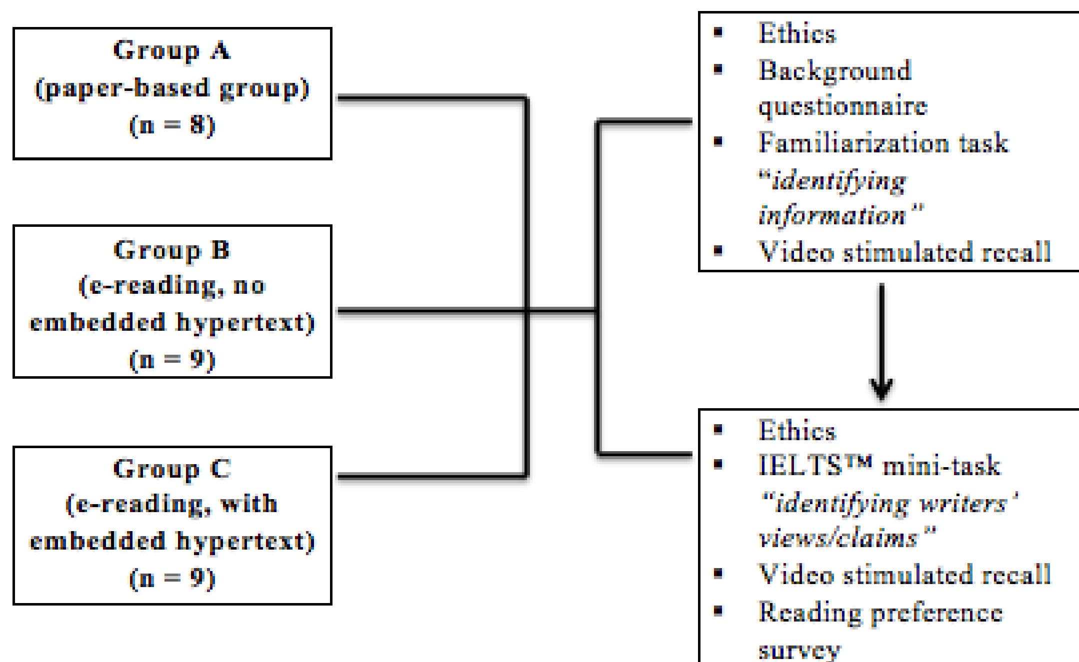

Figure 1. Research design.

3.3. Participants

I first began inviting participants to participate in this study by distributing recruitment materials through various channels (e.g., graduate secretaries, mailing lists, recruitment posters, and so on) (Appendix A). The participants responded to the invitation to participate had to meet the following criteria: (1) Their L1 was Mandarin Chinese, and (2) they reported being registered in a full-time graduate program in a post-graduate university program at the same university, as seen in Table 1[4].

Overall, 26 Mandarin-speaking international graduate students were recruited to participate in the study, with all but two of the participants reporting originating from the Peoples Republic of China (PRC)[5]. The study's participant sample size was chosen for

[4] Five participants reported both IELTS and TOEFL scores, which resulted in overlap in exam score reporting.

[5] One participant reported originating from Malaysia, but reported Mandarin as the mother tongue; the other participant reported originating from Taiwan.

the following reasons: (a) to ensure a reasonable time frame for research completion; (b) to conduct meaningful statistical analyses; and (c) to obtain in-depth reports on strategic behaviour from each participant. While it is important to study different language groups, this study focused specifically on Mandarin Chinese graduate students because (1) they are the largest representative demographic of international students enrolled at the university from which both this study was conducted and this participant sample was recruited, and (2) graduate students' language learning needs are often subsumed with the needs of undergraduate students, when there is evidence supporting the claim that graduate students have their own unique and specialized needs (Huang, 2010b; 2013b); and (c) to minimize learner variability (Guo, 2012; Huang 2013a).

Prior to beginning their participation period in this study, each participant was provided with a consent form (Appendix B), which informed them of their rights and responsibilities as participants, and my responsibilities as an ethically-minded researcher. Every participant was given the option to ask questions at any time, and was verbally informed of the purpose of this study, the expected time needed to participate, benefits, compensation, and their right to withdraw without penalty. Once the participants agreed to participate, they signed the consent form, and were provided with a copy for their records.

The participants were then randomly assigned into one of three reading groups prior to their initial data collection session. The three reading groups were randomly categorized into paper-based reading; e-reading without embedded hypertext (ONH), and e-reading containing embedded hypertext (HT).

3.4. Instruments

This study used the following instruments.

3.4.1. Background Questionnaire

Each participant completed a background questionnaire prior to his/her data collection sessions.[6] This questionnaire elicited information about the participants' background, including name, gender, age, education background, L2 exposure(s), length of residence in Canada, and recent high-stakes testing scores. The questionnaire was adapted from Huang (2013a). Table 1 describes the overall characteristics of the participants, including age, gender, language learning background, and testing scores.

Table 1
Participant Background

Age in years	Mean (years) Range (years)	27 22 - 38	
Length of residence in Canada	Mean (months) Range (months)	16 0.75 - 78	
Gender	Male Female		*n* = 13 *n* = 13
Program	Masters Doctoral		*n* = 18 *n* = 8
Academic Background	Applied Sciences (1); Business (1); Computer Science (1); Economics (2); Education (6); Engineering (5); English (1); Kinesiology (1); Linguistics (5); Physics (1); Psychology (2)		
TOEFL (reported score)	Mean (scores) Range (scores)	98 78 – 113	*n* = 15
IELTS (reported score)	Mean (scores) Range (scores)	6.9 5.5 – 8.5	*n* = 15

Note. *N* = 26

Table 2 provides the descriptive characteristics based on the information provided by each reading group. Similar to Table 1, characteristics included name, gender, age,

[6] See Swain et al., 2009, for a copy of the background questionnaire.

education background, L2 exposure(s), length of residence in Canada, and recent high-stakes testing scores, along with their respective means and standard deviations

Table 2
Descriptive Characteristics by Group

Characteristic	Paper *n* = 8	ONH *n* = 9	HT *n* = 9	Overall *N* = 26
Age (years)	*M* = 27.1 *SD* = 5.0	*M* = 27.2 *SD* = 4.8	*M* = 27.6 *SD* = 4.7	*M* = 27.3 *SD* = 4.7
English language learning (years)	*M* = 14.3 *SD* = 4.6	*M* = 14.1 *SD* = 4.7	*M* = 14.5 *SD* = 4.8	*M* = 14.2 *SD* = 4.7
Gender	Female: 4 (50%) Male: 4 (50%)	Female: 4 (44.4%) Male: 5 (55.6%)	Female: 5 (55.6%) Male: 4 (44.4%)	Female: 13 (50%) Male: 13 (50%)
TOEFL (reported score)	*M* = 98.4 *SD* = 8.2	*M* = 98.0 *SD* = 9.1	*M* = 100.2 *SD* = 8.7	*M* = 98.8 *SD* = 8.7
IELTS (reported score)	*M* = 6.9 *SD* = 0.8	*M* = 6.9 *SD* = 0.7	*M* = 6.9 *SD* = 0.7	*M* = 6.9 *SD* = 0.7

Note. *N* = 26.

3.4.2. IELTS Reading Task

An authentic IELTS reading assessment is 60 minutes long and is typically comprised of three sections (or testlets), each organized around a separate reading passage. These passages, approximately 750 words each, are drawn from a range of sources including magazines, journals, books, and newspapers, with topics of general interest, written for a non-specialist audience. Accompanying the reading passages are a range of questions (40 in total) used to test students' comprehension of material in the 60 minutes allocated. These tasks or techniques are characterized by IELTS (2015) as follows: "reading for gist, reading for main ideas, reading for detail, skimming, understanding logical argument, [and] recognising writers' opinions, attitudes, and purpose."

Due to the heavy content load and the accessibility restrictions in acquiring an authentic IELTS exam, only one of the three sample task types available on the IELTS website[7] was used during each session. These tasks were put through the LexTutor[8] vocabulary assessment program (see Figure 2) to ascertain which tasks available from the IELTS practice test page would be best suited for this study.

			Families	Types	Tokens	Percent
K1 words (1-1000)	Task 1	"The Motor Car"	181	219	500	**75.19%**
	Task 2	"The Risks of Cigarette Smoke"	170	206	554	**71.76%**
K2 words (1001-2000)	Task 1		35	37	41	**6.17%**
	Task 2		25	34	89	**11.53%**
AWL words (academic)	Task 1		34	41	54	**8.12%**
	Task 2		36	40	56	**7.25%**
Off-list words	Task 1		N/A	51	70	**10.53%**
	Task 2		N/A	47	73	**9.46%**
Totals	Task 1		250+	348	665	**100%**
	Task 2		231+	327	772	**100%**

Figure 2. LexTutor results.

As seen in Figure 2, K1 words represented function words and high-frequency content words, while K2 words represented lower-frequency content words. AWL is abbreviated for "academic word list". Finally, off-list referred to words that are not yet existent on the LexTutor vocabulary profiling tool.

[7] http://www.ielts.org/test_takers_information/test_sample/academic_reading_sample.aspx

[8] http://www.lextutor.ca/vp/eng/

The percentages found to the right of each task in Figure 2 represent the total frequency of the words in use for this task. For instance, for Task 1, "The Motor Car," 75.19% of words were function words, or high-frequency content words; 6.17% were low-frequency content words; 8.12% were academic words, and 10.53% of the words found did not exist in the inventory. Meanwhile, for Task 2, "The Risks of Cigarette Smoke," 71.76% of the total words found were function words and/or high frequency content words; 11.53% were lower-frequency content words; 7.25% were academic words, and 9.46% did not exist in the LexTutor inventory.

By comparing the two tasks in Figure 2, the second task was found to have a higher degree of language diversity than the first task. This was necessary so the participants could familiarize themselves with the format of the task during the initial session, while the second session simulated a pseudo-testing environment. Two themes were selected for this study as a result: *identifying information,* and *identifying writers' views/claims*. This was done for two reasons. First, the topics found within these themes were the only two tasks available in the IELTS sample reading test resources that required no prerequisite and/or specialized knowledge to understand the task content. Second, the language diversity between these two tasks was relatively consistent in contrast to other tasks that were examined.

After careful comparison of all available reading tasks, the two tasks selected from the available IELTS resources were titled "The Motor Car" (Appendix C) and "The Risks of Cigarette Smoke" (Appendix D). These reading topics provided comprehension questions rather than matching lists or completing flow charts, both of which can often be found in IELTS test question sections (Moore, Morton, & Price, 2011). Furthermore, they had

similar comprehension question formats in each task, making the two tasks used in the familiarization and data collection sessions consistent in terms of length, format, and comprehension elicitation. This limited potentially introducing uncontrolled variables.

There is evidence in the current body of existing language testing research demonstrating the utility of the IELTS tests (Huang, 2013a), which mitigated the need to search elsewhere for reliable and/or valid academic reading materials. Because IELTS is an internationally recognized language testing system, having undergone rigorous validation, and its use as a high-stakes university entrance examination in 130 countries worldwide, the selection of these tasks for use in an academic reading study was appropriate, especially due to the familiar format, layout, and academic subject matter of IELTS tasks to EAL students. Neither instrument development nor adaptation of alternative instruments was necessary for the study as a result.

3.4.3. Reading Perception Survey

To obtain information about the participants' perceptions towards reading, especially with regards to readers' attitudes about the reading mode(s) used to engage in the reading task (e.g., paper or online), a perception survey was used (Appendix E). This survey consisted of two key components: (1) general questions about EAL learners' reading habits, and (2) specific questions about what kinds of reading media are preferred while engaged in a reading task, which included reporting the various steps EAL readers go through to understand the content they are reading.

The survey afforded the participants an opportunity to assess themselves and their personal attitudes towards their reading performance. The survey also provided an additional source of information about potential individual learner variables (e.g.,

availability and/or accessibility of desired reading materials and ease of reading) in learners' reading strategy use when engaging in reading material through one of the three reading modes. In the event that no strategies were reported or observed in the participants' stimulated recall sessions, it served as a means of corroborating learners' strategy use by triangulating what the students reported about their perceptions to the reading task or to their performances with data I collected during their reading task and stimulated recall.

The purpose of the survey consisted of several key factors. First, it provided an additional resource to observe participants' reading patterns. Second, it assisted in uncovering challenges that EAL graduate readers encounter during a reading task. Third, it enabled the discovery of the attitudes and perceptions that EAL graduate readers have about varying reading formats. Fourth, it provided an environment to learn about EAL graduate readers' habitual behaviours while engaged in academic reading. Finally, it enabled me to gain an approximate idea about how much time EAL graduate readers spend reading in their L2.

While quantitative data can explain scored and numerical data, they are not able to account for all underlying processes that L2 readers are employing for comprehension purposes during their performance. Scores and numerical data are not able to reflect factors such as the reader's affective state, or externally observable behaviour such as gesticulation or facial expressions.

The use of a survey as a secondary data collection instrument equipped me with the necessary tools to uncover a more comprehensive picture of EAL graduate readers' underlying strategic behaviour that would otherwise not have been found through

quantitative analysis. I was thus able to explore strategy use in a manner that transcends numerical data or test scores.

3.5. Data Collection Procedures

To address the research questions, the following procedures were used.

3.5.1. Participant Recruitment

The procedures for participant recruitment were as follows:

1. In April 2013, I recruited 26 international EAL participants from a university in western Canada by e-mail invitations, advertisements (e.g., Facebook invitations, weekly campus-based mailing list distribution), and campus-wide recruitment poster distribution.
2. Each participant who responded was initially sent a letter of information via e-mail that they were instructed to read carefully.
3. After agreeing to participate, the participants' first appointments were scheduled by email, text, or phone call.

3.5.2. Stimulated Recall Procedures

Before describing the procedures of the main study, it is important to describe the stimulated recall procedures that were used with all participants during the course of this study. The following procedures were used for each stimulated recall session:

1. I verbally informed each participant describing the guidelines on how to successfully perform their stimulated recall tasks through the use of a prepared script (Appendix F). Each participant was then given an opportunity to ask any questions they might have about performing their recall task before they began their verbal reports.

2. The participants verbally performed the stimulated recall task, detailing their thought processes before, during, and after the reading task. If there was a silence longer than five seconds during the verbal report, I asked the participant non-guided, non-leading, open-ended questions that were prepared ahead of time to prompt the participants to continue performing the task.

While the two stimulated recall sessions appear to be identical in terms of the steps listed above, the first stimulated recall during the familiarization session was significantly shorter than the stimulated recall task carried out during the main session. Additionally, during the participants' second sessions, the following steps were taken:

3. If the participants elicited what appeared to be a deeper level of strategy use, I asked more in-depth, non-leading, probing questions to try and uncover the strategic processes being reported, as seen in the following example questions:

   "What do you mean when you say "[I] looked for key information?"

   "Could you please tell me more about that?"

   "What do you mean by that?"

4. Each participant was asked about his or her general mental state during his or her performance of the reading task, and how he or she subsequently felt after the task was completed.

5. Each participant was given an opportunity to add any other information they could share about what they were thinking about to conclude the stimulated recall session.

3.5.3. Reading Perception Survey Procedures

It is important to have a clear understanding of the procedures that were used to carry out the reading perception survey used in the main study before describing the procedures carried out during the main study. The procedures used are as follows:

1. Once the participants' verbal stimulated recall reports concluded, I distributed a paper handout of the survey task, verbally instructing each participant to answer all questions to the best of his or her ability.
2. During the completion of this task, all participants were permitted to ask any questions they had regarding the questionnaire.

3.5.4. Main Study

Pilot Study. Before data collection began, three participants were recruited to pilot the research study's reading materials for comprehensibility and to address any potential concerns regarding the data collection tools, the recording equipment, and the reading materials to be used during the study. The participants were Mandarin-speaking EAL graduate students, enrolled in the departments of engineering, linguistics, and music from the same university in western Canada. Each of these participants was randomly assigned to a different reading modality: paper-based reading (paper), e-reading without hypertext (ONH), or e-reading containing hypertext (HT).

To protect confidentiality, each participant individually participated in the pilot study at a designated research lab at a university in western Canada, and was subject to the full-length procedures of the main study, including the following:

1. Ethics. The pilot participants had to read and agree to participate in the study. The consent form provided was identical to the version used for the participants involved in the main study: I verbally outlined the purpose, benefits, and

compensation for each participant, and they were given the opportunity to ask any questions they had prior to signing. I verbally informed them that their data would not be used for the purposes of data analysis. Participants were also informed that their performances would be recorded exclusively for equipment testing purposes.

2. Background questionnaire. The pilot participants filled out the questionnaire, which included their language and education background and recent high-stakes language testing scores.
3. Reading task. The pilot participants were given the reading task to complete for familiarization purposes, using the reading mode that corresponded with their group assignment. Prior to their performances, I verbally instructed them to carefully read the passage and complete the comprehension questions. A 30-minute time limit was provided to complete the reading task, including the comprehension questions. The participants' performance of the reading task was audio- and video-recorded.
4. Post-task stimulated recall. The pilot participants performed their verbal reports, as seen in Section 3.5.2. The duration of the verbal reports was kept very brief, with a maximum of 2 minutes. The entire stimulated recall session was also captured using audio and video recording equipment.
5. Readers' perception survey. The pilot participants completed the questionnaire, as seen in Section 3.5.3. They then informed me of any unclear sections in the questionnaire, including, but not restricted to ambiguity, language structure, unclear phrasing, typos, and so on.

Based on the pilot study results, two alterations were made to the procedures before the main study:

a) I modified how the participants were attended to during the reading stage of their study. With the first two pilot participants, I left them to independently perform their reading task, then later realized that I would potentially be missing out on valuable and overt strategic behaviour. Not every student may be aware of, or consider, their actions to be strategy use, so it was important to incorporate what I found in my observations into the procedures. I used the last pilot study participant to implement the new practice.

b) I revised the time limit that was initially put in place for session two. Due to observed behaviour and verbal reports from the pilot participants that 30 minutes was not necessary to complete one reading task, yet simultaneously taking into account that IELTS™ examinations permit 60 minutes to complete three reading tasks and accompanied comprehension questions, I changed the maximum time limit for session two from 30 minutes to 25 minutes.

c) I took note of a possible computer lag concern regarding the use of Adobe Reader to perform the reading task for the two e-reading groups. As such, I made plans to use Microsoft Word as back-up software to run the reading task in the event that the issue resurfaced.

From April to November 2013, I conducted the main study. The data collection procedures were divided into two sessions, as outlined in Table 3 below. To protect confidentiality, all participants completed data collection individually with me at a designated research lab at the university where this study took place.

Table 3
Data Collection Sessions, Outlined

Session	Paper (n = 8)	ONH (n = 9)	HT (n = 9)
One (35-40 minutes)	• Administered ethics, informed consent, background questionnaire • Administered mini-IELTS™ familiarization task • Practiced stimulated recall	• Administered ethics, informed consent, background questionnaire • Administered mini-IELTS™ familiarization task • Practiced stimulated recall	• Administered ethics, informed consent, background questionnaire • Administered mini-IELTS™ familiarization task • Practiced stimulated recall
Two (40-45 minutes)	• Administered informed on-going consent • Administered IELTS™ reading task (timed research version) on paper • Conducted stimulated recall • Administered learners' perception survey	• Administered informed on-going consent • Administered IELTS™ reading task (timed research version) on computer • Conducted stimulated recall • Administered learners' perception survey	• Administered informed on-going consent • Administered IELTS™ reading task (timed research version) on computer • Conducted stimulated recall • Administered learners' perception survey

Note. N = 26. ONH = Online, no hypertext; HT = Online, with hypertext.

Session One. All the participants in the main study completed their respective sessions individually. The following procedures were used during session one:

1. Each participant was seated at a desk in a designated research lab. Depending on the participant's group assignment, one either had a facedown paper handout in front of him/her, or a laptop facing him/her with sleep mode on so he/she could not look at the task before he/she was to complete it.

2. I presented the participants with the consent form. I verbally reminded them about the purpose of the study, what was involved, compensation, their right to confidentiality, and their right to withdraw at any time without question. They were then asked to carefully read over the consent form and to ask any questions they had about the study before giving their consent to participate.
3. The background questionnaire was distributed. Each participant filled out the questionnaire, including information such as education and language learning history, as well as high-stakes testing scores.
4. The participants were instructed verbally about the familiarization task, which included reading the passage carefully and answering any comprehension questions. At this time, they were permitted to ask any questions about what they were expected to do in their performance once the instructions were finished. The video and audio recording equipment was then turned on to record the participants' performance. The participants were permitted at this time to begin the familiarization task.
5. The participants performed the stimulated recall task, as seen in Section 3.5.2.
6. The session two appointments were arranged for each participant.

The use of an initial session served as a means to familiarize the participants with the procedures undertaken during this study and with the overall task layout, the comprehension questions, and the expectations about how to perform stimulated recall. The session also provided an opportunity to address any questions the participants had about what was expected of them during their participation period, and to address any

technical concerns during video and audio recording that were not discovered during the pilot study.

Session Two. The second session took place one week after session one to minimize potential practice and/or fatigue effects as a result of the training all participants had undertaken during session one. The following procedures were used with all participants during session two:

1. The original consent form was presented again. As with session one, I verbally reminded the participants of their rights and responsibilities as participants in this study. The consent form was then signed by the participants to confirm their ongoing consent to participate in this study, and to give permission for their data from this session to be collected and used for this research.
2. The participants were verbally instructed about the main task, with instructions to read the passage and answer any comprehension questions. At this time, participants were informed that they had 25 minutes to complete the task, including the comprehension questions. The audio and video recording equipment was then turned on, and the participants were given the go-ahead to begin the main task.
3. The participants performed their verbal stimulated recall reports, as seen in Section 3.5.2.
4. Following the verbal stimulated reports, the participants then completed the reading perception survey, as seen in Section 3.5.3.

3.6. Data Analysis

1. Before the data were analyzed, all the data were coded directly from the video recordings, without transcription. This minimized the possibility of missing valuable strategy data from the participants' performance during the task as well as from their post-task stimulated recall tasks. Furthermore, coding data directly from the videos was a step to save time and reduce costs.
2. To protect the confidentiality of the participants' identities during all levels of analysis, all participants' video and audio file names were organized and assigned codes.

3.6.1. Coding Scheme

This study initially used a previously established strategy inventory of learners' speaking strategies to classify the individual strategies found in the collected data (Huang, 2013a). This initial inventory was modified (a) in accordance with the coding decisions of the present study, and (b) due to the requirements of this particular language learning domain (i.e., reading). The result was a modified coding scheme, specifically targeting reading strategies, in an attempt to uncover the strategic behaviour of graduate Mandarin-speaking EAL readers while they engaged in academic reading tasks in English.

The coded data were first labelled by individual strategy and then classified into six primary strategy categories: (1) *approach* strategies, (2) *achievement* strategies, (3) *cognitive* strategies, (4) *metacognitive* strategies, (5) *affective* strategies, and (6) *social* strategies. Individual strategies were classified into these strategy categories by determining where the individual strategies fit based on their intended aims, and where they fit based on the conceptualization of each strategy category. For example,

metacognitive strategies were subcategorized into individual strategies such as *evaluating, identifying problems, self-correction, monitoring time,* and *planning*, which were used by participants to plan, organize, and evaluate what they were doing while engaged in academic reading; whereas *cognitive* strategies were classified into individual strategies such as *using mechanical means, inferring, attending, anticipating questions,* and so on, and were intentionally used by the participants through manipulating the target language to understand the information found in the text.

Some of the individual strategies were broken down into subcategories. For instance, the individual strategy *evaluating* (metacognitive) was divided into the following ten categories: (1) *evaluating affect*, (2) *evaluating performance*, (3) *evaluating strategy use*, (4) *evaluating language skills*, (4) *evaluating reading proficiency*, (5) *evaluating mental process*, (6) *evaluating rating criteria*, (7) *evaluating task*, (8) *evaluating task questions*, (9) *evaluating task format*, and (10) *evaluating previous training*. While these data were coded at the level of individual strategy, they were later collapsed into the category *evaluating* for the purposes of statistical analysis.

Appendix G provides a comprehensive coding scheme of the strategic behaviour found and coded from the data, categorized into their respective strategy categories with an example of each individual strategy extracted from the collected data.

3.6.2. Data Coding Sessions

In terms of data coding, the second coder and I met five times from the period of April 14, 2014 to May 9, 2014 to compare our coding of the collected data. The second coder was an Applied Linguistics Master’s student who speaks Mandarin as a first language and is fluent in English. Each coder independently coded the data of 3 to 4 participants

prior to every meeting, and then met to (a) discuss what strategies were found and (b) discuss any disagreements. I coded 100% of the video data, which were the observed behaviour of the participants performing the reading task, followed by the retrospective verbal reports provided by each individual. Coder 2 coded 53.8% of the video data, consisting of both the observed performance during the reading task and the stimulated recall reports. I then re-coded the remaining 46.2% of the data to establish intra-coder reliability. For the purposes of analysis, all observed and reported strategic behaviours identified in the coded data were combined together.

The video data were played back using QuickTime and VLC[9], and verbal and non-verbal data were coded together so all strategic behaviour found by the coders during the participants' performances could be analyzed. In other words, any observable data found in the participants' performances that were not reported by the participants were added and coded. All disagreements found in the raw video and audio data were recorded and discussed until 100% agreement was reached. The total number of coding decisions for the observed and reported video data was 1,877. Both intra- and inter-coder reliability were checked by dividing the number of agreements by the number of coding decisions. For the inter-coder agreement, the reliability was calculated at 85.88%, while the intra-coder reliability was 85.13%.

The most consistent disagreements found in the data occurred in the contexts below. Following the disagreements are the steps taken for the purpose of resolution.

(1) *Double-coding*. Each reported strategy was coded and cross validated (when applicable) in the participants' verbal reports. In order to avoid double coding a

[9] QuickTime was used for all QuickTime-recorded data via the laptop, and VLC was used for all camcorder recordings.

strategy, the second coder and I had to determine on which occasion the strategy was used. This was double-checked and confirmed in the video and audio data.

For example, many participants reported returning to a specific section of text after reading the comprehension questions in their verbal recall task. The second coder and I found that we would each have coded an instance of *repeating* (achievement) two times – once because we observed the action during the video playback, and once because it was reported by the participant. When this occurred, we discussed it, and eventually decided to strike out one instance for each of the observed coding decision(s) we found in our independent coding sessions. In cases where the reported reference was very specific, we would also cross-validate the action by noting the time in the video in which the action took place next to the coded strategy.

(2) *Multiple strategies:* In some instances, multiple strategies were used across a very short period of time. In this case, the two coders had to determine whether or not all strategies observed and/or reported had been accounted for, and quite often had to revisit the time period in the video clip in question and review it together to confirm whether or not there were more instances.

Participant reported: "I looked into it by purpose… But this task is different from last one, the one we took last week [*evaluating task*]. So it's more find out about the views, the claims of the article [*ID task purpose / attending to task requirements*]. So I think okay, when I saw the title I think okay this time it might be easier [*evaluating task*] because I'm not very good with locating the paragraph information [*evaluating reading proficiency*]."

As seen above, the participant used a number of strategies in a very brief amount of time, not only to determine what kind of task it was, but also to figure out how best to meet the demands of the task. The frequency of metacognitive strategies that this participant reported in terms of planning and evaluating what she had to do outweighed the other kinds of strategies (i.e., approach, cognitive) reported. It took many replays of the video data to gather all of the strategic behaviour found here. Furthermore, it took extra time for the coders to determine whether or not (1) any information was missing from the coded data, and (2) if any information had been double-coded by either (or both) of the coders.

(3) *Achievement strategy category:* Because reading does not tend to use communication strategies as found in Huang's (2013b) speaking strategy inventory, yet reading still tends to employ similar kinds of strategies, the category and many of the individual strategies therein had to be revised and re-operationalized. For example, the individual strategy *repeating* is found in Huang's speaking strategy inventory under *communication* strategies; however, the intention of a speaker is to reiterate or repeat an idea or concept verbally. To contrast, in an academic reading task, *repeating* is the act of returning to a specific section of a reading task in order to find information, or to gain a more in-depth understanding of the content. For the purposes of this study, *repeating* is categorized under a different strategy category (i.e., *achievement*) and defined as an intentional act of returning to a specific section of text that has already been read to achieve a goal.

(4) *Attending strategies:* Due to the nature of attending strategies, the second coder and I determined that it is impossible to determine through observation alone whether

or not attending is being done with a specific purpose that can be classified should there be a lack of observable behaviour by the participant. Therefore, we agreed that observed strategies where participants were clearly attending, but not providing any indication through physical action, should be classified into a general attending category.

Participant reported: "First, I just go over the questions to guide my reading [*using comprehension questions*]. So at the beginning I just go over the four questions and make myself familiar with their contents [*attending task questions*]."

For instances of attending where there were overt indicators, such as the strategy *attending task questions*, where the participant(s) are focusing specifically on the task comprehension questions, the strategy was classified into a more specific individual strategy category. The exception to this occurred in situations where participants reported specifically about a particular time where they were focusing on a specific aspect of the task. If the second coder and I agreed that the verbal report was speaking of a situation that we had initially coded as a general strategy, we deleted the general strategy and coded the specific strategy that the participant verbally reported using.

(5) *Using mechanical means strategies* versus *highlighting strategies*: Different reading modalities employ different behaviours for different purposes. As such, due to the necessary strategic behaviours performed, the second coder and I agreed that strategies that are seemingly similar could be used with differing aims to reach comprehension goals; therefore, they must be categorized accordingly.

For instance, a participant from the paper group might engage in underlining, circling, or otherwise marking up the paper in front of them (*using mechanical means*).

Superficially it appeared that this strategy might simply be used to draw attention to the word for later reference; however, the coders found that the participants often had a sophisticated code to their mechanical means strategy use that transcended marking keywords. Some marks indicated keywords; some marks indicated where the participant had deduced one (or more) of the answers to be – one participant even reported circling words that they recognized to be medical terminology that they felt they did not have to bother investigating further. Because their strategic behaviour was comprehension-driven and involved the manipulation of the language in a way that drove them to perform the task in what they perceived as successful, the use of mechanical means was categorized into *cognitive* strategies.

Meanwhile, participants in the e-reading groups might double-click to highlight a particular word or phrase, change the colour of the text, or perhaps change the size of the text. The primary purpose for these strategies was to facilitate easier recognition of the word or section in the event that the participant chose to reference it later in the task. Unlike the paper group, the highlighting strategies often were used as a way to break up sections of text into meaningful chunks. Because these actions were planned, intended to achieve comprehension goals rather than to manipulate the language, the e-reading participants' actions were categorized as *achievement* strategies, defined as alternative, goal-oriented resources used when faced with comprehension difficulties (Yule & Tarone, 2014).

3.6.3. Statistical Analysis

Normality Test. Before I began my statistical analysis, I first conducted a normality test to determine the appropriate statistical tests to use. Raw frequency counts from the coded data were used. The one-way Kolmogorov-Smirnov (KS) and Shapiro-Wilk (SW) tests of normality distribution included a table of statistical values and a series of histograms to account for each strategy category measured, as seen in Table 4 below.

Table 4
Test of Normality

		Group	App	Ach	Cog	Meta	Aff	Soc
N		26	26	26	26	26	26	26
Normal parameters	*M*	2.00	4.50	24.12	34.96	7.65	2.35	0.12
	SD	.849	2.82	13.77	17.14	4.54	1.38	0.33
Most extreme differences	Absolute	.227	.120	.176	.184	.211	.219	.523
	Positive	.227	.120	.176	.184	.211	.219	.523
	Negative	-.227	-.087	-.129	-.104	-.114	-.165	-.362
Test statistic		.227	.120	.176	.184	.211	.219	.523
Asymp. Sig (2-tailed)		**.001**	.200	**.036**	**.023**	**.001**	**.002**	**.000**

Note. One-sample Kolgormorov-Smirnov statistical test. App = Approach; Ach = Achievement; Cog = Cognitive; Meta = Metacognitive; Aff = Affective; Soc = Social. Information in bold represents values that deviate from normality.

Due to the high standard deviation values and non-normal distribution of the strategy categories (see Figure 3), nonparametric statistical analyses were used for data analysis. All data analysis was performed using IBM SPSS (Statistical Package for the Social Sciences) Version 23 and Microsoft Excel 2011.

Homogeneity of Variance. In MANOVA, the variances of each dependent variable should be homogeneous across each of the three reading groups. This is determined by using the Levene's test of homogeneity of variance, as seen in Table 5. One of the strategy categories (i.e., social) violated the assumption of homogeneity of variance due to its low frequency ($n = 3$; $p = .003$) and was omitted from the multivariate analysis.

Table 5
Test of Equality of Error Variance

Variable	*F*	*df1*	*df2*	*p*
Approach	.485	2	23	.622
Achievement	2.696	2	23	.089
Cognitive	2.313	2	23	.122
Metacognitive	1.129	2	23	.341
Affective	.065	2	23	.937
Social	**7.537**	**2**	**23**	**.003**

Note. *N = 26.* Information in bold represents a violation of homogeneity as assessed by Levene's test of homogeneity of variance ($p < .05$).

A Box M test was then used to confirm that the variance of the dependent variable was relatively equal across the three reading groups (see Table 6). The results confirmed that there were no significant differences among the regions in the covariance matrices (p = .479), and that the observed covariance matrices of the dependent variables were equal across groups.

Table 6
Box's M Test of Equality of Covariance

Box's M	44.357
F	.992
df1	30
df2	1626.183
Sig.	.479

Note. Design: Intercept+ReadingGroup. Social was omitted due to the violation from the Levene's statistical test.

Language Pre-Test. I rated 100% of the participants' pre-test language data, taken from their verbal reports during session one. The purpose was to corroborate the reported scores from each participant's background questionnaire, and to ensure consistency in the speaking proficiency among the participants. Although the participants all reported their

recent high-stakes language testing scores on their background questionnaires, it was important to ensure that the participants demonstrated advanced language proficiency.

These verbal reports were rated again, three weeks after the initial rating. Any disagreements between the first and second ratings were rated a third time two days later to obtain the final score; in each disagreement, the third rating matched the higher of the two, and became the final score. No disagreements in the rating scores were larger than 0.5 points. Once all disagreements were 100% resolved, the rating scores were measured for intra-rater reliability using a Spearman *rho* correlation, resulting in a positive coefficient of .855 (p = .000) and confirming reliability. Throughout the analysis phase of this study, the rated pre-test scores were corroborated with the participants' reported high-stakes testing scores, and then used as the participants' language proficiency scores.

Answering the Research Questions. Research Question 1 asked about the number of strategies reported by readers in the PA-, ONH-, and HT-reading groups. Using the raw frequencies found in the coded data and the task scores, I used a combination of Microsoft Excel and SPSS version 23 to obtain descriptive statistics for EAL academic reading strategy behaviour. Descriptive statistics were calculated on a number of levels: (a) for all groups combined, using the six strategy categories; (b) for each group separately, using the six strategy categories; and (c) for each group separately, using the individual strategies within each of the six strategy categories.

Research Question 2 asked what the differences in reading strategy use were among the three reading groups. Using SPSS 23, I conducted a multivariate analysis (MANOVA) to ascertain whether or not there were any significant differences among the three groups' strategic behaviour. Although the data distribution was not normal and the

number of participants in each reading group was small, MANOVA is a robust statistical tool, which means that the subsequent analysis of the data should not necessarily be negatively affected by deviations from normality (Huang, 2013a). MANOVA has the capability to compare all three groups to each other. Each reading group was the independent variable, and the identified individual strategies (categorized into their respective strategy categories) were the dependent variables.

Research Question 3 asked about the relationships between strategy use and reading performance across the three groups. I used the Spearman *rho* correlation test to determine any potential relationships between strategy use and the reading groups at the three levels (i.e., strategy category level across all participants, strategy category level across the three groups, and individual strategy level across the three groups).

3.6.4. Qualitative Analysis

In order to further cross-validate the results of the quantitative analysis through the use of a third source of data, thematic analysis was used to interpret the individual responses from each participant's reading perception survey (Miles, Huberman, & Saldaña, 2014). For the purposes of analysis, all the data were organized and categorized using Microsoft Excel 2011. The responses to each question were first carefully examined to gain a sense of what was present in the raw data. A coding scheme was then developed from the data found in the raw data (Appendix H) based on the identified individual themes found in the participants' responses. This coding scheme was collapsed from the total number of subcategories into more comprehensive, broad categories based on the underlying commonalities underpinning the participants' responses. Any strategies reported in the participants' survey responses were coded, recorded, and added to the quantitative data.

Any strategy data that was not already accounted for in the quantitative data was added to the raw frequency data.[10]

An additional coder (Coder 2) was recruited to independently code 100% of the responses in the qualitative data for the purpose of establishing inter-coder reliability. Coder 2 holds a Master's in Applied Linguistics, is an experienced researcher in the field of EAL strategy use, and whose L1 is Mandarin and L2 is English, making her a qualified second coder for the qualitative data. Coder 2 and I each coded all the data independently, then over the course of one phone meeting examined the disagreements found in the data. All disagreements were recorded and discussed until 100% agreement was reached. The total number of coding decisions totalled 239. Inter-coder reliability was then checked by dividing the number of agreements by the number of coding decisions, resulting in 90.91% agreement.

While the number of disagreements were few (n = 23), there were two disagreements between the two coders, occurring in the contexts below. Following the disagreements are the steps taken for the purpose of resolution.

1. *Cost* versus *efficiency:* In two instances, one coder coded examples of time- and financially-related responses under *cost*, while the other categorized time-related responses under *efficiency*, and financially-related responses under *cost*. The two coders then had to determine and agree upon what constituted "cost". Due to the context of the two participants' answers, the result was that time-related reasons were categorized under *efficiency*, as each of the two instances referred to reading

[10] 1,916 = 1,877 (quantitative data) + 39 (survey data)

faster under specific conditions; meanwhile, any financially-related reasoning would be categorized under *cost.*

2. *Multiple themes:* In some situations, multiple individual themes were found across a very small portion of data. The coders had to ascertain how many individual themes were found, where they took place in the raw responses, and whether or not over-coding (i.e., finding themes that were not necessarily backed up concretely by the participants' responses) was taking place. The raw data was then examined again and double-checked for any other additional information.

   Example response, Q. 8-2: *"Too many funny news on the net that I cannot concentrate* [Convenience: Focus]; *besides I like the feel of books-reading* [Comfort: Physical]*"*.

In this case, the two coders agreed that the latter clause fell into the primary thematic category of comfort, but could not definitively distinguish whether or not the word *feel* referred to physical touch or a mental feeling. It was agreed that neither could be concretely excluded, given the context; furthermore, both coders agreed that it was possible that the participant could be referring to both themes. As a result, both individual themes were included.

Finally, the group-specific, open-ended questions found in the second section of the survey were triangulated (when possible) to the quantitative data, using the reported strategies to establish cross-validation to the quantitative analysis.

Chapter 4: Results

This chapter has been divided into four subsections, organized by this study's three research questions and the results of the qualitative analysis. Each research question underwent multiple levels of analysis. For the purposes of this chapter, the research questions were addressed under the assumption that each strategic action is happening simultaneously and together, rather than separately, or in a linear or sequential order (Huang, 2013a).

4.1. Research Question #1: Reported Reading Strategies

What are the reading strategies reported by EAL learners who use paper-based materials, EAL learners who use e-reading materials without hypertext, and EAL learners who use e-reading materials containing hypertext?

4.1.1. Identified Strategy Use

The frequency of all individual reading strategies were first organized by strategy category. A total of 83 individual strategies were identified from the participants' data. Overall, the instances found in the data amounted to 1,916 individual strategies.

Table 7
Descriptive Statistics of Overall Reading Strategy Use by Category

Strategy category	App	Ach	Cog	Meta	Aff	Soc
Frequency	117	627	911	197	61	3
Min	0	1	1	1	1	1
Max	10	24	29	8	9	1
M	4.50	4.79	4.60	1.33	2.34	1
SD	2.82	5.49	5.39	0.83	1.91	0.00
Percentage	6.11%	32.72%	47.55%	10.28%	3.18%	0.16%

Note. *N* = 26. App = Approach; Ach = Achievement; Cog = Cognitive; Meta = Metacognitive; Aff = Affective; Soc = Social.

Frequency refers to how many times a particular strategy was identified in the coded data. *Range* indicates the difference between the most instances a strategy used from the minimum value to the maximum value. *Mean* (*M*) represents the average frequency across all three groups, and *standard deviation* (*SD*) refers to "the root-mean-square of the set of deviations between each element of the set and the mean of the set" (Berkeley, 2015, Standard Deviation). Finally, *percentage* is the percentile value of each strategy category related to the total number of identified strategies in the data.

The mean frequency from all the coded data in Table 7 was 3.10 ($SD = 2.74$). Over 80% of the overall identified individual strategies in the coded data belonged to the achievement and cognitive strategy categories. As a result of the high frequencies across these two strategy categories, I performed a Spearman *rho* correlational analysis to determine whether the two categories had any possible associations with each other. Several positive correlations were found across the strategy categories, with three statistically significant values appearing between the following strategy categories: (a) cognitive and achievement ($r = .746$, $p = .000$), (b) achievement and metacognitive ($r = .487$, $p = .012$), and (c) achievement and affective ($r = .426$, $p = .030$). These findings suggest that the increased employment of achievement strategies may be associated in some way to increased use of cognitive, metacognitive, and affective strategies.

Table 8 shows the total frequency of all identified individual strategies by category, frequency, range, *M*, *SD*[11], and their respective percentages to a) the strategy category they belong to, and b) the overall identified strategies.

[11] Instances where the *SD* appears as N/A is due to the strategy in question being reported by only one participant.

Table 8
Identified Individual Strategies by Strategy Category

Strategy category	Individual strategy	Total	Min	Max	*M*	*SD*	% in relation to strategy category	% in relation to overall strategy use
Approach: Involving what the test-taker/reader does to orient him- or herself to the task	Developing reasons	83	1	9	3.77	2.02	70.94%	4.33%
	Generating ideas	1	1	1	1.00	N/A	0.85%	0.05%
	ID task format	3	1	1	1.00	0.00	2.56%	0.16%
	ID task purpose	4	1	1	1.00	0.00	3.42%	0.21%
	Making choices	14	1	4	1.75	1.16	11.97%	0.73%
	Using comprehension questions	12	1	1	1.00	0.00	10.26%	0.63%
Achievement: Involving what the test-taker/reader does when faced with comprehension difficulties	Abandoning	6	1	1	1.00	0	0.96%	0.31%
	Adjusting hardware	12	1	2	1.33	0.50	1.91%	0.63%
	Anticipating task length	1	1	1	1.00	N/A	0.16%	0.05%
	Anticipating task type	1	1	1	1.00	N/A	0.16%	0.05%
	Approximating	1	1	1	1.00	N/A	0.16%	0.05%
	Avoiding	13	1	2	1.30	0.48	2.07%	0.68%
	Chunking	1	1	1	1.00	N/A	0.16%	0.05%
	Guessing	11	1	2	1.10	0.32	1.75%	0.57%
	Highlighting (enlarging text)	15	1	10	3.75	4.27	2.39%	0.78%
	Highlighting (text colour)	19	6	13	9.50	4.95	3.83%	1.25%
	Highlighting (w/	5	5	5	5.00	N/A	0.80%	0.27%

	cursor)							
	Highlighting (underlining)	24	1	9	4.00	2.95	3.84%	1.28%
	Linking	31	1	3	1.48	0.68	4.94%	1.62%
	Linking to previous training	5	1	2	1.25	0.50	0.80%	0.26 %
	Referring to notes	2	2	2	2.00	N/A	0.32%	0.10%
	Referring to questions	173	1	24	6.65	4.92	27.59%	9.03%
	Repeating	304	5	24	12.16	6.01	48.48%	15.87%
	Slowing down	1	1	1	1.00	N/A	0.16%	0.05%
	Using L1	2	2	2	2.00	N/A	0.32%	0.10%
Cognitive: Involving manipulating the target language in order to understand or produce language	Analyzing linguistic choices	2	1	1	1.00	0.00	0.22%	0.10%
	Analyzing questions	6	1	2	1.20	0.45	0.66%	0.31%
	Anticipating questions	4	1	1	1.00	0.00	0.22%	0.21%
	Attending	337	3	29	12.96	6.39	37.07%	17.59%
	Attending questions	140	1	14	5.38	2.50	15.40%	7.31%
	Attending to task content	14	1	3	1.27	0.65	1.54%	0.73%
	Attending to task requirement	6	1	2	1.20	0.45	0.66%	0.31%
	Attending w/ cursor	2	1	1	1.00	0.00	0.22%	0.10%
	Attending w/ cursor (hovering)	106	1	25	8.83	8.67	11.66%	5.53%

Attending w/ pen	18	2	6	3.60	1.82	1.98%	0.94%
Attending w/ pen (hovering)	35	1	13	5.00	4.20	3.85%	1.83%
Directing search	4	1	3	2.00	1.41	0.44%	0.21%
Inferring	6	1	1	1.00	0.00	0.66%	0.31%
Making predictions	17	1	3	1.55	0.82	1.87%	0.89%
Memorizing	7	1	1	1.00	0.00	0.77%	0.37%
Recalling what was read	2	1	1	1.00	0.00	0.22%	0.10%
Skimming	6	1	2	1.50	0.58	0.66%	0.31%
Translating	1	1	1	1.00	N/A	0.11%	0.05%
Using context cues	7	1	2	1.40	0.55	0.77%	0.37%
Using intuition	4	1	1	1.00	0.00	0.44%	0.21%
Using keywords	17	1	3	1.13	0.52	1.87%	0.89%
Using mechanical means (chunking)	3	3	3	3.00	N/A	0.33%	0.16%
Using mechanical means (circling)	25	3	6	4.17	1.33	2.75%	1.30%
Using mechanical means (making notes)	30	2	8	5.00	2.19	2.75%	1.30%
Using mechanical means (misc. markings)	21	1	13	3.25	4.20	3.30%	1.57%
Using mechanical means (underlining)	71	2	16	8.88	5.06	7.81%	3.71%
Whispering	15	1	3	2.14	0.90	1.65%	0.78%

Metacognitive: Involving organizing, planning, and evaluating	Anticipating results	4	1	1	1.00	0.00	2.01%	0.21%
	Anticipating time used	1	1	1	1.00	N/A	0.50%	0.05%
	Attending to exam designer's conceptualization	3	1	1	1.00	0.00	1.51%	0.16%
	Evaluating affect	24	1	2	1.20	0.41	12.06%	1.25%
	Evaluating language skills	3	1	1	1.00	0.00	1.51%	0.16%
	Evaluating mental process	8	1	1	1.00	0.00	4.02%	0.42%
	Evaluating performance	33	1	8	1.83	1.76	16.58%	1.72%
	Evaluating previous training	2	1	1	1.00	0.00	1.01%	0.10%
	Evaluating rating criteria	1	1	1	1.00	N/A	0.50%	0.05%
	Evaluating reading proficiency	2	1	1	1.00	0.00	1.01%	0.10%
	Evaluating strategy use	16	1	5	1.45	1.21	8.04%	0.84%
	Evaluating task	34	1	3	1.55	0.67	17.09%	1.77%
	Evaluating task format	2	1	1	1.00	0.00	1.01%	0.10%
	Evaluating task questions	10	1	2	1.25	0.46	5.03%	0.52%
	Generating future solutions	1	1	1	1.00	N/A	0.50%	0.05%
	Generating	1	1	1	1.00	N/A	0.50%	0.05%

	future strategies							
	Generating goals	4	1	2	1.33	0.58	2.01%	0.21%
	ID problems	6	1	2	1.20	0.45	3.02%	0.31%
	Monitoring time	3	1	2	1.50	0.71	1.51%	0.16%
	Planning	2	1	1	1.00	0.00	1.01%	0.10%
	Reviewing	18	1	2	1.20	0.41	9.05%	0.94%
	Self-correction	12	1	3	1.71	0.76	6.03%	0.63%
	Self-monitoring	1	1	1	1.00	N/A	0.50%	0.05%
	Setting goal	6	1	1	1.00	0.00	3.02%	0.31%
Affective: Involving self-talk or mental control over affect	Justifying affective state	4	1	2	1.33	0.58	6.56%	0.21%
	Justifying performance	43	1	4	1.87	0.92	70.49%	2.24%
	Justifying strategy use	10	1	2	1.11	0.33	16.39%	0.52%
	Monitoring affective state	4	1	2	1.33	0.58	6.65%	0.21%
Social: Involving interacting with the examiner/in-structor in order to perform the task	Asking examiner questions	1	1	1	1.00	N/A	33.33%	0.05%
	Asking interlocutor for word meaning	1	1	1	1.00	N/A	33..33%	0.05%
	Request external support	1	1	1	1.00	N/A	33.33%	0.05%

To gain a deeper understanding of the frequency of these individual strategies, smaller individual strategies with similar underlying themes (e.g., *evaluating task*, *evaluating performance*; *attending questions*, *attending w/ pen*) were collapsed into larger, broader categories (i.e., *evaluating*, *attending*). Among the 83 identified individual strategies, the ten most frequently used individual strategies were found in every strategy category except the social strategy category. These individual strategies, along with their descriptive statistics, percentage to the respective strategy category, and percentage to the overall identified strategies, are presented in Table 9.

Table 9
Ten Most Frequently Identified Individual Strategies

Rank	Strategy Category	Individual Strategy	Freq.	*M*	*SD*	% in relation to category	% overall strategy use
1	Cognitive	*Attending*	658	25.31	10.29	72.39%	34.34%
2	Achievement	*Repeating*	304	11.69	6.35	48.48%	15.87%
3	Achievement	*Referring to questions*	169	6.50	5.07	48.48%	8.82%
4	Cognitive	*Using mechanical means*	155	5.96	9.22	17.05%	8.09%
5	Metacognitive	*Evaluating*	135	5.19	3.16	67.84%	7.05%
6	Approach	*Developing reasons*	83	3.19	2.32	70.94%	4.33%
7	Achievement	*Highlighting*	63	2.42	5.46	10.08%	3.29%
8	Affective	*Justifying*	57	2.19	1.36	93.44%	2.97%
9	Achievement	*Linking*	36	1.38	1.10	5.74%	1.88%
10	Metacognitive	*Reviewing*	18	0.69	0.68	9.05%	0.94%

Note. Information in bold represents the most frequent strategy categories found in the reported data (n = 1,678). Freq = Frequency.

The ten individual strategies (n = 1,678) listed in Table 8 comprised 87.58% of the overall individual strategies identified in all of the coded data. The majority of these individual strategies came from cognitive and achievement strategy categories, which

accounted for 82.54% of the top ten most commonly identified individual strategies found in the coded data, while the metacognitive, approach, and affective strategy categories represented the remaining 17.46%. The individual strategies found within the social strategy category were not present in the ten most frequently reported strategies.

4.1.2. Frequency in Each of the Three Reading Groups

Each reading group used a wide array of individual strategies, with the paper group leading with 750 (39.14%), followed by ONH with 608 (31.73%), and HT with 558 (29.12%)[12]. Table 10 shows the descriptive statistics for each reading group[13].

Table 10
Descriptive Statistics for the Frequency of Six Reading Strategy Categories

Group	Strategy category	Frequency	*M*	*SD*	% in relation to category	% overall strategy use
Paper *n* = 8	App	44	5.50	2.93	37.61%	2.30%
	Ach	229	**28.63**	**12.81**	**36.52%**	**11.95%**
	Cog	406	**50.75**	**17.77**	**44.66%**	**21.19%**
	Meta	48	6.00	2.51	24.12%	2.51%
	Aff	21	2.63	1.41	34.43%	1.10%
	Soc	2	0.25	0.46	66.67%	0.10%
ONH *n* = 9	App	30	3.33	2.18	25.64%	1.57%
	Ach	229	**25.44**	**17.66**	**36.52%**	**11.95%**
	Cog	250	**27.67**	**16.31**	**27.39%**	**13.00%**
	Meta	76	8.56	6.11	38.69%	4.02%
	Aff	23	2.56	1.24	37.70%	1.20%
HT *n* = 9	App	43	4.78	3.15	36.75%	2.24%
	Ach	169	**18.78**	**9.11**	**26.95%**	**8.82%**
	Cog	255	**28.22**	**6.98**	**27.94%**	**13.26%**
	Meta	73	8.22	4.21	37.19%	3.86%
	Aff	17	1.89	1.54	27.87%	0.89%
	Soc	1	1	N/A	33.33%	0.05%

Note. *N* = 26. App = Approach; Ach = Achievement; Cog = Cognitive; Meta = Metacognitive; Aff = Affective; Soc = Social. Information in bold represents the top two most frequent strategy categories used in each reading group.

[12] Percentages are in relation to the overall identified strategies found in the coded data.

[13] Insufficient data to calculate descriptive statistics for social category in the ONH and HT groups.

Similar to Section 4.1.1., the two most frequently identified strategy categories across all three reading groups were the cognitive and achievement categories. The paper group used more individual strategies in the cognitive category (*n* = 406) than the two e-reading groups (ONH = 229; HT = 254). The frequencies of the achievement category were identical for paper (*n* = 229) and ONH, in contrast to HT (*n* = 169). The use of metacognitive strategies was similar across the two e-reading groups (HT = 74; ONH = 77), while the paper group accounted for 48 identified instances. As seen in Table 11, approach and affective strategies were relatively consistent across all three e-reading groups. Finally, social strategies were used the least frequently across the three groups (Paper = 2; HT = 1; ONH = 0).

Table 11
Most Frequently Identified Individual Strategies by Category[14]

Group	App	Ach	Cog	Meta	Aff
Paper *n* = 8	Developing reasons *n* = 36 (81.81%) *M* = 4.50 *SD* = 2.51	Repeating *n* = 119 (51.97%) *M* = 14.88 *SD* = 7.38	Attending *n* = 232 (57.14%) M = 29.00 *SD* = 10.58	Evaluating *n* = 33 (68.75%) *M* = 4.13 *SD* = 1.96	Justifying *n* = 20 (95.24%) *M* = 2.50 *SD* = 1.60
ONH *n* = 9	Developing reasons *n* = 21 (70.00%) M = 2.33 *SD* = 2.06	Repeating *n* = 95 (41.48%) *M* = 10.56 *SD* = 7.30	Attending *n* = 209 (83.94%) *M* = 23.22 *SD* = 13.07	Evaluating *n* = 52 (67.53%) *M* = 5.78 *SD* = 4.18	Justifying *n* = 23 (100.00%) *M* = 2.56 *SD* = 1.24
HT *n* = 9	Developing reasons *n* = 26 (60.47%) *M* = 2.89 *SD* = 2.09	Repeating *n* = 90 (53.25%) *M* = 10.00 *SD* = 3.24	Attending *n* = 217 (85.43%) *M* = 24.11 *SD* = 6.45	Evaluating *n* = 50 (67.57%) *M* = 5.56 *SD* = 2.96	Justifying *n* = 14 (82.35%) *M* = 1.56 *SD* = 1.13

Note. *n* = 1,237. App = Approach; Ach = Achievement; Cog = Cognitive; Meta = Metacognitive; Aff = Affective. Percentages are based on the raw frequency from each respective strategy category.

[14] Social category was omitted due to the lack of frequency required to establish descriptive statistics.

As seen in Table 11, the most identified individual strategies showed generally consistent frequencies with respect to each strategy category across the three reading groups, accounting for 64.56% of all individual strategies identified in the data. The largest differences in the frequency of individual strategy for each group in proportion to the strategy categories use appeared in (1) the cognitive category; (2) the affective category; and (3) the approach category, with up to a 25% difference in the frequency of individual strategy use among the three reading groups.

Table 12
Top Five Most Frequently Identified Individual Strategies by Group

	Paper	ONH	HT
Most used individual strategies	**Attending** (30.93%) Using mechanical means (19.47%) **Repeating** (15.87%) **Referring to questions** (12.00%) Developing reasons (4.80%)	**Attending** (34.38%) **Repeating** (15.63%) Evaluating (8.55%) Highlighting (7.89%) **Referring to questions** (7.73%)	**Attending** (38.89%) **Repeating** (16.13%) Evaluating (8.96%) **Referring to questions** (5.73%) Developing reasons (4.66%)

Note. *N* = 26. Percentages represent the overall frequency in all of the strategies identified in the coded data. Information in bold refers to strategies used most frequently in all three groups.

Each group's top five most frequently used strategies made up the majority of the identified strategies in the coded data, with frequencies of 83.07% for the paper group, 74.18% for the ONH group, and 74.37% for the HT group, respectively. As seen in Table 12, each of the three reading groups has similarities with one another in terms of their individual strategy use, with *attending*, *repeating*, and *referring to questions* appearing in each of the three reading groups as the most commonly used individual strategies.

In terms of differences, the ONH and the HT groups reported *evaluating* more frequently than the paper group did, with their frequencies ranking third in the top five most reported strategies. However, the paper group reported *using mechanical means* as an important strategy, ranking above *repeating*. While the ONH group did identify *highlighting* as a frequently employed individual strategy, the HT group did not, citing *developing reasons* as a more frequently used individual strategy.

4.2. Research Question #2: Inter-Group Differences

What are the differences in the reading strategies among the three groups?

Based on the diagnostic tests of Section 3.6.3., the data from the identified strategies used during the main study did not strongly violate the assumptions necessary to use MANOVA[15]. To identify the potential variance among the three reading groups, a one-way MANOVA was conducted using Wilks' Lambda (Λ)[16]. The descriptive statistics of each group undergoing the multivariate analysis can be found in Table 13.

[15] The social strategy variable could not be normalized due to its low frequency of usage; therefore, it was omitted from the MANOVA analysis.

[16] Wilks Λ was used due to being the most commonly employed MANOVA statistical test.

Table 13
Descriptive Statistics of Dependent Variables, Overall and by Group

	Reading Group	*M*	*SD*	*N*
Approach	HT	4.78	3.15	9
	Paper	5.50	2.93	8
	ONH	3.33	2.18	9
	Total	4.50	2.82	26
Achievement	HT	18.78	9.11	9
	Paper	28.62	12.81	8
	ONH	25.44	17.66	9
	Total	24.11	13.77	26
Cognitive	HT	28.22	6.98	9
	Paper	50.75	17.77	8
	ONH	27.67	16.31	9
	Total	34.96	17.45	26
Metacognitive	HT	8.22	4.21	9
	Paper	6.00	2.51	8
	ONH	8.56	6.11	9
	Total	7.65	4.54	26
Affective	HT	1.89	1.54	9
	Paper	2.63	1.41	8
	ONH	2.56	1.24	9
	Total	2.35	1.38	26

A significant result was found in the reading groups, with the Wilks' Λ showing statistical significance in the independent variable: *F* (5.000, 38.000) = 2.535, $p = .013$; Wilks Λ = .360; partial $\eta^2 = .400$. The results can be seen in Table 14.

Table 14
Wilks' Lambda Multivariate Analysis

Effect	Value	*F*	Hypothesis df	Error df	Sig	Partial Eta Square	Noncent. Parameter	Observed Power
Reading Group	.360	2.535	5.000	38.000	**.019**	.400	25.346	.894

Note. Wilks' Λ statistical test. **Significance when $p < .01$.

As shown in Table 15, there was a statistically significant difference in cognitive strategy use between the participants in each reading group: F (2, 23) = 7.011, p = .004; partial $\eta^{2\,=}$ .379.

Table 15
Results of Wilks-Lambda Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Square	df	Mean Square	*F*	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power
Reading Group	Approach	20.944	2	10.472	1.357	.277	.106	2.713	.262
	Achievement	435.001	2	217.501	1.162	.331	.092	2.324	.230
	Cognitive	**2881.906**	**2**	**1440.953**	**7.011**	**.004**	**.379**	**14.022**	**.890**
	Metacognitive	32.107	2	16.053	.763	.478	.062	1.526	.164
	Affective	2.899	2	1.449	.741	.488	.061	1.482	.160
Error	Approach	177.156	23	7.720					
	Achievement	4359.653	23	189.550					
	Cognitive	**4721.671**	**23**	**205.302**					
	Metacognitive	495.056	23	21.524					
	Affective	53.653	23	2.333					

Note. Computed using alpha = 0.5. Information in bold represents statistically significant strategy category.

As a result of the statistically significant findings in the multivariate analysis, post-hoc tests on the cognitive strategy category were necessary to examine the findings with more depth. The analysis was performed by following up the significant value found in the cognitive strategy category with a Tukey HSD statistical test. The interactions between the cognitive strategy category and the independent variable (i.e., the reading groups) can be found in Table 16. As seen below, there were two significant differences found between the reading groups in the cognitive category. These occurred between: (1) HT and Paper (M = 28.22 vs. 50.75; SD = 6.98 vs. 17.77; p = .010); and (2) Paper and ONH (M = 50.75 vs. 27.67; SD = 17.77 vs. 16.31; p = .008).

Table 16
Cognitive Interaction Effects by Reading Group

Dependent Variable	(I) Reading Group	(J) Reading Group	Mean Difference (I-J)	Std. Error	Sig.	95% confidence interval	
						Lower Bound	Upper Bound
Cognitive	**HT**	**Paper**	-22.53*	6.966	**.010**	-39.97	-5.08
		ONH	.56	6.758	.996	-16.37	17.48
	Paper	HT	22.53*	6.966	.010	5.08	39.97
		ONH	23.08*	6.966	**.008**	5.64	40.53
	ONH	HT	-.56	6.758	.996	-17.48	16.37
		Paper	-23.08*	6.966	.008	-40.53	-5.64

Note. Tukey HSD post-hoc statistical test. $N = 26$. **Significant when $p < .01$.

4.3. Research Question #3: Relationships Between Reported Strategy Use and Reading Task Performance

What are the relationships in the reported reading strategy use among EAL readers and their reading performance?

I conducted Spearman *rho* tests to determine the extent to which there were relationships between the participants' strategic behaviour and their overall performance in the main reading task. The correlational analysis was done at three levels of interpretation: (a) as a whole, with all three groups combined; (b) in groups, comparing each strategy category separately; and (c) in groups, comparing the use of individual strategies separately.

4.3.1. Overall Strategy Category Use and Task Performance

There were no significant correlations found when examining all participants' strategy use by category and any potential association(s) of each strategy category to participants' reading task scores, as seen in Table 17.

Table 17
Overall Task Scores Across all Strategy Categories

		App	Ach	Cog	Meta	Aff	Soc
Task score	Correlation Coefficient	.098	-.227	-.240	.171	.146	.052
	Sig. (2-tailed)	.635	.264	.238	.404	.475	.802

Note. Spearman *rho*. $N = 26$. App = Approach; Ach = Achievement; Cog = Cognitive; Meta = Metacognitive; Aff = Affective; Soc = Social.

4.3.2. Comparing the Three Reading Groups by Strategy Category Use and Task Performance

There were no significant correlations found between the use of strategy categories and task performance for either the HT group or the paper group. However, a significant positive correlation was found with the ONH group between the use of approach strategies and reading task performance ($r = .676$, $p = .046$), suggesting the possibility that the increased use of approach strategies could be associated with higher task scores.

4.3.3. Comparing the Three Groups by Individual Strategy Use and Task Performance

I conducted correlational analyses to determine if there were any correlations between each of the three reading groups' task scores and the use of the identified individual strategies found in each of the strategy categories.

Approach Category. For the paper group, a negative correlation was found between the *using comprehension questions* strategy and reading task scores ($r = -.741$, $p = .036$). For the ONH group, there was a positive correlation between *developing reasons* and task scores ($r = .774$, $p = .014$). The HT group showed no significant correlations.

Achievement Category. There were no significant correlations found, overall or in the three reading groups, in the use of individual achievement strategies and participants' reading task scores.

Cognitive Category. *Anticipating questions* had a significant positive correlation (r = .454, p = .020), suggesting that the use of this particular strategy may be positively associated with reading task scores.

When comparing the three reading groups, the paper group exhibited statistical significance between individual strategy use and task scores. Two significant correlations were found between (1) *making predictions* and reading task scores (r = -.717, p = .045), and (2) *whispering* and reading task scores (r = .723, p = .043). Neither the ONH group nor the HT group had individual strategies that significantly correlated with reading task scores.

Metacognitive Category. Comparing the overall use of individual metacognitive strategies and the three reading groups separately revealed no significant correlations in the use of metacognitive reading strategies and participants' reading task scores.

Affective Category. There were no individual strategies that showed statistically significant correlations, overall or in the three reading groups, in the use of affective strategies and participants' reading task scores.

4.4. Qualitative Data - Survey

The reading perception survey (see Section 3.4.3.) aimed to uncover the participants' perceptions with regards to their perceived reading habits, preferences, and strategic actions. Each reading group received 10 identically framed, open-ended, non-guiding questions in the first section of the survey. The second section of the survey was also open-ended and non-guiding in format. As a result, all participants were able to disclose as much (or as little) information as they wished for each question, which means that many of the questions were only answered by a percentage of the participants. The two

sub-sections below illustrate the findings with regards to the participants' reading habits and overall perception of their reading preferences.

4.4.1. General Reading Habits

In terms of general habits, participants reported for questions 1-4 that English was read more than L1, with a mean reading time of 3.80 hours per day. The participants also reported e-reading English for longer periods of time than reading on paper, with a mean time difference of nearly an hour. When comparing the average time spent reading across all three groups, the results were similar: E-reading in English had a longer reading duration per day than paper reading, with an average weekly duration of 11.9 hours spent reading electronically[17]. When each group was compared to one another, some differences were found. The ONH group displayed a wider range of overall English reading duration than the paper and the HT reading groups. The paper group showed a longer duration spent reading in their L1 than the two e-reading groups did, with an average of 3.5 hours per day. In contrast, the ONH group showed a lower overall duration for L1 reading than the other two groups.

The participants were asked in questions 5-7 about their general reading habits, including (a) whether or not they switched reading modes during reading task(s); (b) to what extent they printed out online readings before reading; and (c) to what extent they read online without printing reading materials out. Several recurring themes were identified in the data, which were thematically coded and categorized into broader, larger categories based on what the themes had in common. These categories were used to account for participants' reasons for engaging in reading behaviours that they were asked

[17] Weekly reading duration by group (hours) was 12.16 (Paper), 6.21 (ONH), and 17.77 (HT).

about during this section of the survey. All the coded data were then classified into the following primary categories, each consisting of their own individual sub-categories: (a) value; (b) comfort; (c) convenience; and (d) learning. Three other stand-alone categories were added which had no individual sub-categories: (e) environment, and (f) pleasure. Appendix H provides the coding scheme showing how the raw identified data have been categorized, both by individual themes and primary categories, while Appendix I illustrates the frequency of each individual theme found by group.

Figure 3 provides the frequency of each primary category as coded from the participants' responses in questions 5–7 of the survey. The stand-alone categories (i.e., environment, pleasure) have been collapsed into a single unit (i.e., "other") due to their low frequency. As shown in the figure, the most frequently thematic category identified in the overall data was convenience (n = 59), while the least used was other (n = 8). The overall frequency of identified individual themes in questions 5-7 among all three groups totalled 120. Some examples of these themes are shown in the raw data below, with the individual type distinguished in parentheses.

1. *Comfort* (Physical): "I prefer to reading on paper since I feel it is helpful for my eyes." (P18, Q5)
2. *Convenience* (Accessibility): "When I'm studying, I use internet to find something I couldn't find in the textbook. After find my answer, I will switch back to paper." (P24, Q5)
3. *Learning* (Task-oriented): "By reading the abstract, if I find it very hard or/and very important to my academic study, I print them out." (P14, Q6)

4. *Value* (Frequency of Use): “If the readings is often used, I would print it out and bring it with me. For other things I won’t print it out.” (P17, Q6)
5. *Other* (Environment): “If it is very, very long, I will [also] read on-screen, because I don’t want to use too much paper. So I think if something that is useless to me, I won’t print out.” (P25, Q7)

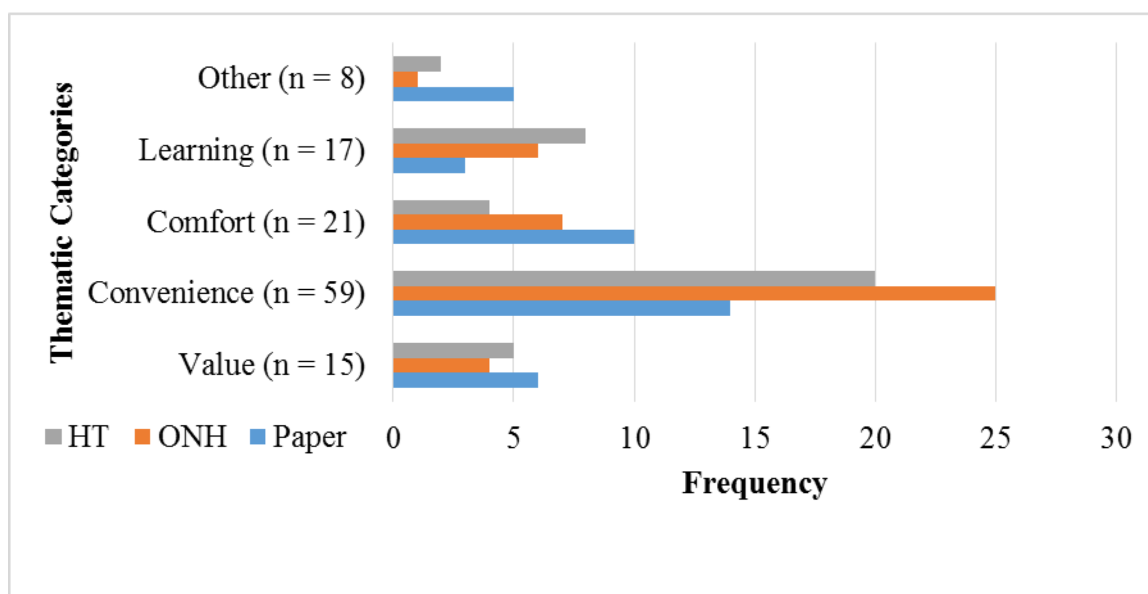

Figure 3. Identified themes when reporting general reading habits (e.g., daily time spent reading).

As seen in Figure 3, convenience themes were reported more often by the ONH group and least often by the paper group. The HT group reported learning themes more often, while the paper group reported them least often. Value themes were identified similarly across the three reading groups, while comfort themes were reported more by the Paper group than the two e-reading groups. Finally, the Paper and HT reading groups reported other reasons (e.g., *environment*, *pleasure*) more frequently than the ONH group.

Of the 26 participants who responded to question 5, 20 (88.46%) responded that they read on handheld devices such as iPhones, Kindle, Kobo, and iPad when they read English online. The remaining 6 participants (23.08%) reported not using handheld

devices to e-read in English, and instead reported using only computers for e-reading purposes. The average time using handheld devices to read per week was 11.55 hours, with a reported time range of 0.5 – 40 hours. No participants reported using no form of technology to read.

In terms of questions 6, which asked about participants' inclination to switch reading modalities from paper to e-reading (and vice versa), thirteen participants (50.00%) reported switching from reading online to reading on paper, while 4 (15.38%) reported that they did not switch from e-reading to paper-reading.[18] Of the 13 respondents who switched, 5 (38.46%) came from the paper group, 6 (46.15%) were from the ONH group, and 2 (15.38%) were from the HT group. Finally, in response to question 7, participants generally tended to report occasionally printing reading materials instead of reading them online (n = 9), while the remainder of the respondents reporting printing often/always (n = 5) or never (n = 1).

4.4.2. General Reading Preferences

Questions 8-10 asked participants about their perceptions towards reading performance, and their preferences in reading modality use. The number of themes identified in the data for questions 8-10 among all three reading groups totalled 118 individual instances[19]. Participants across all three reading groups reported preferring reading on paper to reading online (n = 17), with two participants preferring to e-read and four not explicitly reporting a preference for one reading mode over another.[20] Fourteen of the 26 participants reported remembering information better when reading on paper

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[18] N/A: n = 9 (34.62%).

[19] The number of themes identified in questions 5-10 of the survey totaled 238.

[20] One participant did not clearly state her reading preference. Her input to this section was excluded.

than when e-reading, while six reported no difference in retaining information while reading on either modality. None of the participants reported feeling that they remembered more by reading online than when they read on paper.

Some examples of these themes are shown in the raw data below, with the individual theme type distinguished in the parentheses.

1. *Comfort* (Familiarity): "I still feel uncomfortable with the e-reading mode. Maybe compared to the time I spent on paper reading, I spent too little time e-reading." (P4, Q8)
2. *Convenience* (Utility): "On paper you can mark the text so the highlighted words and phrases will help you remember things more clearly." (P9, Q9)
3. *Learning* (Memory): "[that means] I should read and remember the details and I will get a good memory about the article." (P8, Q8)
4. *Value* (Research): "For tough and boring academic reading, I feel I remember things more clearly while reading on paper. But when reading for pleasure, it doesn't matter." (P20, Q9)
5. *Other* (Environment): "Paper, only if I can recycle it after; E-reading, I can save and pull it out again to read without hassle of storing them physically like book/paper." (P1, Q10)

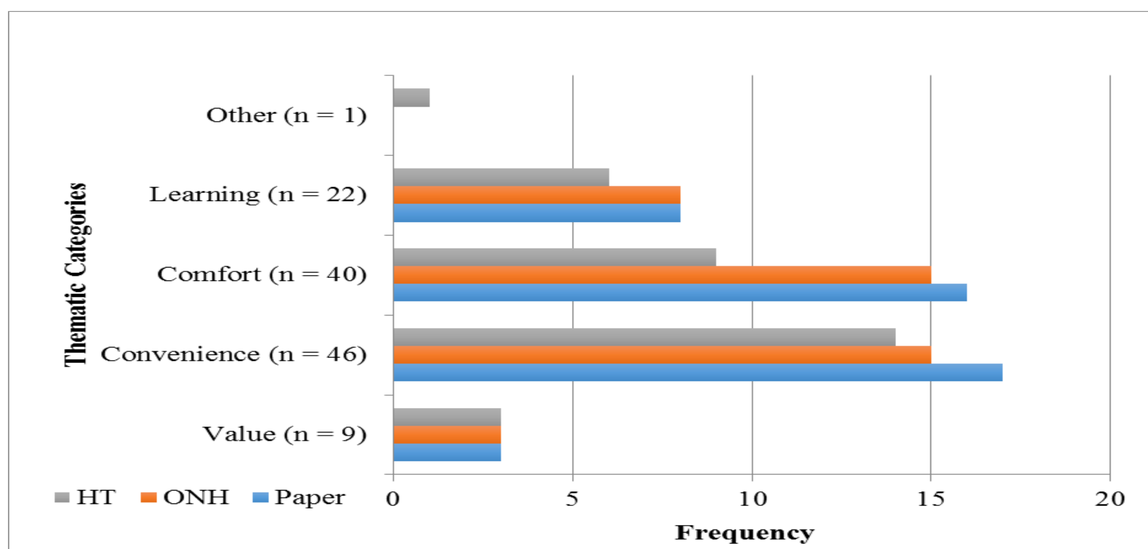

Figure 4. Identified themes when asked about performance and reading modality preferences.

Figure 4 illustrates the frequency of identified themes pertaining to reading perceptions and preferences in questions 8-10. Participants who reported either having no modality preference or reported reading online extensively generally preferred paper-based reading for readings that they considered difficult in nature. For instance, one participant reported that if the reading had a length of more than three pages that she would print it because she felt she was not good at e-reading. Another participant felt that she could read longer when reading on paper than online because e-reading made her feel tired. The three participants who reported preferring e-reading to paper-based reading gave reasons such as economic concerns (e.g., reading online was more cost-effective than purchasing books or printing articles on paper); environmental (e.g., one participant was explicit about her concern of environmental damage); and general efficiency during task performance, for preferring e-reading over paper. One participant's response to explaining his/her preference was "[I] almost always read on computers. Better efficiency, because of the freedom of re-organizing the content in a preferable layout."

Another participant reported preferring e-reading due to its utility, such as easier access to external support tools (such as translation devices) that could aid in facilitating comprehension.

On the whole, participants who reported preferring paper-reading to e-reading reported two primary reasons for their preference. First, several participants felt that e-reading was bad for the eyes and/or made their eyes tired; therefore, they were more inclined to read on paper if the reading task was extensive, or perceived to be difficult in nature. In addition, participants who preferred reading on paper often reported that they felt they remembered information better when reading on paper to reading online. There was no explicit information from the participants explaining why they felt this way.

Chapter 5: Discussion

This chapter presents a discussion of this study's findings. The first section of this chapter provides a summary of key findings from the study in order of the three guiding research questions and the qualitative analysis, accompanied by a discussion pertaining to the findings. The second explores the limitations of this study. The third discusses implications of this study to the current state of knowledge, and the last section provides possible future research directions and the conclusion.

5.1. Key Findings and Discussion

5.1.1. Summary of Overall Findings

This present study adopted a research design using both quantitative and qualitative data to investigate Mandarin-speaking EAL graduate students' strategic behaviour in academic reading. The quantitative data was used as the primary information source, while the qualitative data from the survey instrument served as additional, complementary source of information used to further explain and/or discuss information found from the data.. Eighty-three individual strategies were identified from the participants' performances in both their main reading task (i.e., what was observed during their task performance), their verbal stimulated recall (i.e., what was reported during the recall), and the survey data. These individual strategies were then classified together into six reading strategy categories (approach, achievement, cognitive, metacognitive, affective, and social), according to the participants' intended aims. Overall, the number of individual strategies employed by the 26 participants totalled 1,916. Through the observation of participants' performances and the reports provided through the

participants' post-task verbal stimulated recall tasks, I attempted to identify and analyze the reading strategies that Mandarin-speaking EAL graduate students use while engaged in an English academic reading task across two different reading modes. Data was collected from three sources of information: (1) the data observed during the participants' performance of the main reading task, (2) the data reported by the participants during their verbal stimulated recall, and (3) the data reported by the participants in their post-task reading perception surveys.

The findings indicate that the participants employed a wide range of reading strategies while engaged in the academic reading task, which is consistent with current literature showing that strategy use is non-linear and does not occur in isolation (Cai, 2014; Cohen & Macaro, 2007; Doe & Fox, 2011; Guo, 2012; Huang, 2013a; Zhou, 2014). Six categories of strategies were identified in the coded data, which were categorized into 83 individual strategies. The most frequently identified strategy category was cognitive (n = 911, 47.55%), followed by achievement (n = 627, 32.72%), metacognitive (n = 197, 10.28%), approach (n = 117, 6.11%), affective (n = 61, 3.18%), and social (n = 3, 0.16%). These findings reflect similar EAL research contexts (Akyel & Erçetin, 2009; Guo, 2012), in that L2 learners most frequently employ cognitive strategies while engaged in EAL learning tasks. However, these findings contrast with Swain et al., (2009) concerning the least frequently used strategy categories; Swain et al. found affective strategies least frequently, while this study found social to be least frequently employed. Such results may reflect domain-specific needs in L2 learning, as Swain et al.'s findings were the result of examining L2 speaking tasks, while this study examined L2 reading. These results are reflected similarly with regards to individual strategy use,

where the most frequently individual strategy used with respect to each strategy category was the same across all reading groups (see Table 11).

Correlational analyses were conducted among all participants and compared among all participants across multiple levels. While no statistically significant results were found with regards to task scores and category-level strategy use across all participants, a positive correlation was found at the individual level between *anticipating task questions* (cognitive) and participants' overall task scores. When compared by reading group, the paper group and the ONH group revealed a mixture of correlations, both positive and negative. This finding seems to indicate that, generally, the use of strategies does not necessarily ensure reading comprehension success, and that EAL readers' strategy employment is a complex set of behaviours that may positively or negatively contribute to comprehension when in combination with other strategies (Huang, 2010b).

Results from the qualitative analysis revealed a number of themes in the survey reports, including convenience, comfort, learning, and value, which were broken down into individual themes. Other thematic categories found in the data included environment and pleasure. Overall, convenience was the most frequently identified theme, while pleasure was the least frequently identified. The ONH group tended to identify more themes in their survey feedback than the other two reading groups. The HT group identified the fewest themes. In terms of reading preferences, there was considerable favour given towards reading on paper than to e-reading, regardless of reading group. Participants generally reported being able to remember information better, and feeling they performed reading tasks better when reading on paper.

5.1.2. Reported Reading Strategies Among Paper, ONH, and HT Groups

Cognitive and achievement were the two most frequently used strategy across all three reading groups, which is in line with recent literature (Akyel & Erçetin, 2009; Karbalaei, 2010), but counters Huang's findings (2013b), where strategy use during the IELTS speaking test revealed a more robust employment of metacognitive strategies (37.86%) compared to the findings of this study (10.28%). The difference may be a domain-specific contrast, given that this study examined reading strategies and Huang investigated speaking strategies; however, the disagreement in the findings warrants further scrutiny, particularly due to recent research demonstrating the value of metacognitive strategy use in successful reading comprehension (e.g., Alsheikh & Mokhtari, 2011; Alhaqbani & Riazi, 2012; Carrell, Gajdusek, & Wise, 1998; Iwai, 2009, 2011; Karbalaei, 2010). These results also contrasted with previous research indicating that strategies used for compensatory purposes were not frequently employed in reading (Mirzaei et al., 2014). In Mirzaei et al., for instance, compensatory strategies were classified as a separate strategy category and were thus analyzed that way, which may explain the departure from the findings of this study. Determining whether or not a particular strategy was being used for compensation was beyond the scope of this study, as the intentions behind strategy use are multi-faceted, and compensation may not be the sole reason to applying a specific strategy to a reading task.

In terms of overall individual strategy employment, the top five most frequently used individual strategies across all groups were *attending, repeating, referring to questions, using mechanical means,* and *evaluating*, totalling 1,410 instances, which agrees with findings from other strategy research (Huang, 2013a). The frequency of these five strategies alone accounted for 75.11% of all the employed individual strategies identified

in all of the individual strategy data. Although the total frequency of individual strategies differed among the three groups, the frequency of individual strategy use among the three groups remains very consistent overall, with each reading group reporting the same individual strategies most frequently with relation to strategy category (see Table 11).

Most frequently identified individual strategy use with respect to overall strategy frequency was also relatively consistent by group (see Table 12), with the only differences appearing in (1) the paper group, where *using mechanical means* ranked second most frequently used, and (2) the ONH group, where *highlighting* ranked fourth most frequently used. The HT group shared characteristics with both reading groups, with no unique individual strategies found that were not found in one of the other reading groups. These results seem to indicate that, despite the reading modality difference, participants attempted to use similar strategies across all three reading groups. However, findings have postulated that using strategies uniformly across different reading modes may not result in uniform comprehension success (Mangen et al., 2013), which adds to a growing body of evidence towards the non-linear nature of strategy use in language learning, and that different combinations of individual strategies may potentially work for or against each other (Guo, 2012).

5.1.3. Differences in Reading Strategy Use Among the Three Groups

Although the overall reading strategies by participants are similar overall and by reading groups, the results suggest that there are differences between groups in terms of reading strategy use. All results showing differences in strategy use were found in the cognitive category. According to Oxford (1990), cognitive strategies are strategies which are employed to understand and produce the target language; this operationalization has

been in use more or less consistently since its conception. As a result, cognitive strategies tend to be more widely employed in terms of L2 language learning (Guo, 2012). Given this evidence, it is not unreasonable to suggest that cognitive strategies are more frequently in use for EAL reading tasks given the nature of EAL learning, even at the graduate level of education.

The MANOVA analysis revealed statistically significant interactions between the HT and paper reading groups (M = 28.22 vs. 50.75; SD = 6.98 vs. 17.77; p = .010), and between the paper and the ONH reading groups (M = 50.75 vs. 27.67; SD = 17.77 vs. 16.31; p = .008). As seen above, the paper group had a significantly higher mean and standard deviation when compared to the HT and ONH groups, which indicates a higher and more varied use of reading strategies in the cognitive category by the reading group when compared to its e-reading counterparts. This result may be due to a number of factors including familiarity with the reading modality, or participants' preferences towards paper-based reading for intensive reading purposes (seen also in Chou, 2009). Previous research has also indicated that preferences towards academic e-reading tends to be low due to student's perceived inability to effectively use strategies while e-reading (Chou, 2011). Combined with the survey feedback showing support for printing out articles perceived to be important or frequently used for class and/or research purposes, it is understandable that the paper group would employ a greater variety of strategies with more frequency than the ONH and the HT groups.

5.1.4. Relationships in the Reported Reading Strategy Use Among EAL Readers and Reading Task Performance

While the 26 participants' overall use of strategies with relation to task scores revealed few statistically significant findings at the categorical level, there were a number of statistically significant findings uncovered when examining the results at an individual level, which are organized first across all groups, followed by each reading group.

Overall. There was a lack of statistical significance when examining potential relationships between overall strategy use and task performance among all participants. Neither overall findings from the coded data, nor the findings based on the data from each of the three groups revealed any significant associations between metacognitive strategy use and task performance, which contrasts to the majority of the literature on metacognitive strategy use in L2 English, both during and after a reading task (e.g., Alsheikh & Mokhtari, 2011; Huang, 2013a; Taki, 2015). However, when the strategy categories were divided into their respective individual strategies, one significant positive result was revealed in the cognitive strategy category between *anticipating questions* and reading task scores (r = .454, p = .020) when analyzed among all participants.

Paper Group. There was a negative correlation found in the approach category between *using comprehension questions* strategy and reading task scores (r = -.741, p = .036). This was expected, given that many participants within their reading group were observed during their performances approaching the main task by first looking at the comprehension questions and then proceeding to engage with the remainder of the task material. This finding counters Huang (2013a), however, who found positive associations between individual approach strategies and performance. Other significant findings for the paper group lay within the cognitive strategy category, existing between: (1) *making*

predictions and reading task scores (r = -.717, p = .045), and (2) *whispering* and reading task scores (r = .723, p = .043).

HT Group. There was only one significant finding revealed for the HT group in the approach category, between *ID task purpose* and task scores (r = .694, p = .038).

ONH Group. It was found that the overall use approach strategies were positively correlated with the participants' reading task scores in the ONH group (r =.646, p = .046), which suggested the possibility that the increased use of approach strategies while engaged in academic reading tasks may be positively associated with reading task scores. Further examination revealed that these results specifically involved the individual approach strategy *developing reasons* and task scores (r = .774, p = .014). The other finding was in the achievement category, where a possible positive correlation was found between reading task scores and the individual strategy *abandoning* (r = .655, p = .056). While not statistically significant, this finding warrants further scrutiny.

The results for the paper group with regards to the association between *using comprehension questions* and reading task performance indicates a possibility that EAL graduate readers who engage in academic reading tasks on paper may use task questions to guide their reading, suggesting purpose-driven, goal-oriented, strategic behaviour. However, the negative correlation suggests a general possibility that the increased use of comprehension questions to facilitate task performance may not be as beneficial as once assumed. This finding is important, given that the use of comprehension to guide performance is a common strategy found in English language assessment preparation for exams such as IELTS or TOEFL, and was explicitly reported by one of the participants in the verbal stimulated recall data.

The differences between the paper group and the ONH group, particularly with regards to their statistically significant differences in the cognitive category, provides evidence that strategy use may depend not only on reading task demands, but also on the demands of the medium on which the reading task is being employed. While one would anticipate that similarly employed strategies among the three groups would lead to similar findings in the correlational analysis, neither e-reading group revealed negative correlations based on their frequency data. The ONH group, by contrast, showed positive correlations between reading task scores and the use of approach strategies at the category level, which possibly indicates that the general use of approach strategies in online academic reading potentially facilitate successful reading performance. Considering that the most identified strategies were used with similar frequency among all three reading groups, this provides evidence that reading modes can potentially factor into which strategies EAL readers decide to use for a given task.

5.1.5. Qualitative Findings

There was an overall preference towards reading on paper than e-reading across all three reading groups when it came down to academic reading, which supports Chou's findings pertaining to on-screen reading behaviour (2009, 2011), along with other related studies (Foasberg, 2013, Kang et al., 2009). Many participants reported preferring to read online for "easy" tasks, such as social media, short articles, English newsreels, leisure reading, and so on, but would often report printing out or otherwise shifting to a paper-based reading modality in order to engage with more extensive reading tasks; this was also found by Chou (2009, 2011). This especially applied to academic contexts, where participants felt overall that they performed better reading academic articles on paper

than reading online, which is supported by much of the existing literature (Chou, 2011; Kang et al., 2009; Rho & Gedeon, 2000). Many reasons were provided regarding the participants' overall preference to read on paper, with the most frequently cited reason being comfort, particularly with regards to the development of eye-strain (Park & Kim, 2011; Kang et al., 2009; Mangen, Walgermo, & Brønnick, 2013) and the preference for tactile engagement with the reading task (Berg, Hoffman, & Dawson, 2010).

An unexpected discovery was the HT group's opinions regarding the use of hyperlinks. Not one participant in the HT group clicked on the hyperlinks during the main task. Results from the survey indicated that unless hypertext was directly related to completing the task requirements, or it was clear that the links were required for more information pertaining to the task that it was considered more disruptive than beneficial. These findings correspond to Chou (2011), who found that hypertext "did not increase [EAL graduate students'] on-screen reading engagement" (p. 17). Furthermore, similar to Chou's findings, the present study revealed through the perception survey that despite the extensive accessibility of digital academic reading material, that students preferred to print out academic articles for careful reading. This may be related to the strategies that the participants preferred to use. For example, participants in the paper group quite often tended to take notes in some fashion, whether it was by circling keywords, underlining phrases, or using miscellaneous markings to guide their reading. E-reading greatly limits the ability to do this, and studies have shown that trying to use equivalent strategies on the computer can be problematic for students (Mangen et al., 2013).

Although many participants reported printing academic articles before reading the content, a few reported skimming the article for information before printing it out, which

is supported by previous studies (e.g., Abdullah & Gibb, 2006; Berg, Hoffman, & Dawson, 2010; Chou, 2011). There are a few possible reasons why skimming may take place prior to printing. First, and most likely, is that participants want to confirm the relevance of academic articles prior to printing them out and reading them. The second is that participants may have attempted to read the article, but due to the onset of eye fatigue and/or strain, or possibly even finding that they cannot engage with reading materials online as well as they have found they can in previous experiences, and thus decide to print the article out, which has been pointed out in previous research findings (Berg, Hoffman, & Dawson, 2010; Kang, Wang, & Lin, 2009)

Another reason, while not directly related to the preference to paper, is the potential extent that e-reading may ultimately distract EAL readers from their academic reading task. Several students in the perception survey reported that reading online could be more distracting than helpful, which is supported by Foasberg (2013) and was also identified as a potential issue by Margolin, Driscoll, Toland, and Kegler (2013). This concern applied especially when participants in the HT group were asked to what extent they felt hypertext benefited their reading. Similarly, Mangen et al. (2013) postulated that paper-based reading contains multiple levels of accessibility through “visual and tactile cues,” whereas e-readers were “restricted to seeing (and sensing) only one page at any given time of reading” (p. 66), suggesting that visually interacting with the material alone may in fact, either (1) detract from e-reading effectiveness due to the restriction of a valuable strategic processing tool, or (2) add to the cognitive load in terms of what is being seen, resulting in poorer comprehension and less effective visual mapping of the material.

5.2. Implications

5.2.1. Empirical Implications

The overall findings in this study showed no statistically significant relationships between a given reading group's strategy use at the category level and task performance. Though there were some results indicating statistical significance at the individual strategy level, assumptions cannot be made of the general absence of statistical significance in the data (Alderson, 2004; Huang, 2013a). It is likely that the limited sample size was insufficient to achieve enough statistical power, particularly since 26 participants were divided into three different reading groups. However, there were some instances where statistical significance was discovered. Overall, a positive association was found in the cognitive category between the use of *anticipating questions* and task performance when compared across all participants. This finding seems to indicate that regardless of which mode one uses for reading, that the employment of this individual strategy may positively enhance reading task scores.

When all three groups were compared to one another, however, the findings were mixed. Both positive and negative statistically significant associations were found for the paper group in the approach and cognitive categories, while the ONH group only showed positive correlations. Such differences in the results indicates that strategy use is a complex set of behaviours, whereupon employing different combinations of strategies during a reading task may be beneficial or detrimental to reading success (Guo, 2012; Huang, 2010b, 2013b). Furthermore, given the differences for each group in the results of the correlational analysis, one might postulate that strategy use may not be as effective if they are employed in a uniform way when using different reading modes to interact with a given task. The paper group had more statistically significant findings, but they were

also the only group to have negative correlations between individual strategies (i.e., *using comprehension questions, making predictions*) and the task scores. This indicates that the employment of certain individual strategies may either work with, or against, one another, which substantiates Guo's (2012) findings in EAL writing strategy research.

When examining strategy use at the categorical level among each of the reading groups, the ONH group showed positive correlations with task performance when the approach strategy was in use during the reading task. When narrowed down to the individual level, it was discovered that the significant positive association existed between the *developing reasons* strategy and reading task performance. It is possible that students may perceive themselves to be using more of their cognitive resources while working online. The results from the survey confirmed that many of the participants in this study perceived e-reading to be, on some level, more strenuous and/or difficult than reading on paper, and therefore, it would make sense that participants feel that they must be highly selective about what they read, due to this perceived cognitive strain. This purposeful method of approaching a reading task confirms the claim made by other researchers that participants use strategies intentionally (e.g., Kang, 2014; Swain et al., 2009; Huang, 2013a), and that when used effectively, may be associated in some way to performance outcomes.

The paper group, on the other hand, showed unexpected findings. While not statistically significant at the category level, the results showed a negative correlation at the individual strategy level between *using comprehension questions* and task performance. The use of comprehension questions is a common strategy that is taught explicitly by EAL instructors, particularly when preparing for high-stakes language

examination. Given that the reading task used in this study is a testlet based on IELTS test material, there is a likelihood that, despite the simulated context in which this study is taking place, that EAL readers would reach for reading strategies that (a) are familiar, or have been used previously in similar contexts; and (b) are perceived to have worked for them in test situations. However, the negative correlation provides evidence that not all strategies may work effectively toward the intended outcome (i.e., to perform well on the test). In this case, the negative association suggests that, in paper-based texting contexts, that using comprehension questions may not enhance performance.

5.2.2. Methodological Implications

This study is novel to the current body of EAL reading strategy literature in a number of ways. First, the present study, to my knowledge, is the first of its kind in the field to collect and analyze three different sources of data. Observation data were collected while the participants performed the main task. Immediately following the reading task, the participants reported their strategic behaviour by means of stimulated recall. Finally, the perception survey was used to collect additional information, reported by the participants in their own words.

Second, this study used a modified coding scheme, which allows researchers and instructors alike to (1) collect information based on any observations made, and (2) to collect information based on verbal reports. Both kinds of data are invaluable to enriching existing knowledge about EAL strategic behaviour. The primary instrument(s) used to collect data on EAL reading strategy use tend to be questionnaires and/or strategy inventory lists. This modified coding scheme can contribute to future reading strategy

research, in which other EAL researchers can modify and develop their own coding schemes based on the instrument used in this study.

Finally, to my knowledge, this is the first study of its kind to use multivariate statistical analysis in examining reading strategy behaviour in EAL reading, let alone EAL graduate students' reading strategy use. An exhaustive search of current literature revealed no EAL reading strategy research investigating multiple variables. The results of this study have identified 83 different individual strategies used by EAL readers while engaged in an academic reading task, and with one-third fewer participants than used in the Margolin et al.'s 2013 study. Furthermore, the strategic behaviour identified in this study's data came from multiple sources, and multiple levels of analysis were employed. To contrast, Margolin et al. only identified 8 reading behaviours, all of which were external and observable. Although Margolin et al. also employed multivariate analysis to examine reading behaviour, it neither explored reading strategy behaviour with the same breadth and depth that this study has endeavoured to do.

5.2.3. Pedagogical Implications

Based on observed performances, participants' stimulated recall reports, and participants' survey data, it was found that participants were very conscientious of their behaviour while engaged in their reading task, with constant attention being paid to selecting and evaluating the effectiveness of the individual strategies they used during their performance. This supports the general consensus in EAL reading literature that reading is a highly strategic process, and that EAL readers intentionally use a variety of different strategies to support comprehension, including compensating when comprehension fails, planning and evaluating comprehension and/or reading task aims,

and achieving comprehension and/or task goals (Block, 1986; Swain et al., 2009). While the results of this study have shown that EAL readers tend to employ similar means of strategy use regardless of the reading modality they are using, it may be unwise for both EAL instructors to assume that graduate EAL students would be equally comfortable with using both kinds of reading modes. Practicing caution in assuming EAL students' English reading abilities, both online and offline, is especially critical given the multimodal nature of education in the Western world today.

The findings from this study agree with results from numerous studies (e.g., Swain et al., 2009; Huang, 2010a; Zhang, Goh, & Kunnan, 2014): EAL strategy use tends to be largely cognitive-oriented, followed by strategies that help to achieve goals, whether the strategies are problem-solving in nature, compensatory, or task-driven (i.e., aimed at completing the task). The results show that in the domain of EAL reading, this also appears to be the case across all modalities. While the use of metacognitive strategies were not found to be statistically significant to EAL reading in this study, as was found in Huang (2013a), excluding the importance of their employment in reading would be unwise, as several recent studies in EAL strategy research have found that they are highly employed strategies and may play a role in the reading process (Huang, 2013a; Zhang & Seepho, 2013). As with any analysis, an absence of significance does not mean that significance is absent (Alderson, 2004).

E-reading is a complex process, requiring different kinds of strategies and skills in order to navigate successfully through reading tasks (Chou; 2009; Coiro, 2011), and it has been indicated in several studies that EAL reading uses more working memory than reading in one's L1 (Macaro, 2006; Mangen et al., 2013; Takeuchi et al., 2012). It should

come as no surprise, then, that the reading preference for academic reading overwhelmingly sways towards reading on paper, as it is well-supported by research that paper is widely preferred for engaging in intensive reading, such as one would find in an academic task (Chou, 2009, 2011; Cohen & Upton, 2007). While recent findings have suggested that readers' receptivity towards e-reading is increasing (Gilbert & Fister, 2015), the degree of familiarity in e-reading and reading modality preference has been met with mixed results (Dobler, 2015; Woody, Daniel, & Baker, 2010). The survey results from this study indicated that exposure to e-reading through academic reading made little difference to participants' reading modality preference. Similar to previous research (Abdullah & Gibb, 2006), the survey results not only showed an overt preference for reading on paper, but also that some participants did not like e-reading, and thus attempted to avoid it whenever possible. The dislike of e-reading was substantiated through many participants' verbal reports. Types of e-reading avoidance included reporting (via survey) using paper equivalents of e-reading tasks or printing out materials, while e-reading tended to be reserved for leisure, such as reading newsreels, social media, or other pleasure reading, which was also found in Chou's online reading study (2009).

Chinese EAL students, in some cases, appear to have inadequate training of how to read in a screen-based environment (Chou, 2011), which is an invaluable -- and arguably, necessary -- asset for successfully negotiating the demands of academic reading. Furthermore, it seems that for many of the participants in this study, e-reading was not something that was done for academic purposes until they arrived in an English-speaking country to study, indicating that not only do EAL students potentially not have the

skillset to effectively read online, but also that university instructors may be assuming that because EAL readers have successfully been accepted into an English-speaking graduate school that these skills have already been acquired. Based on these findings and current literature, it is important for instructors and researchers alike to be mindful of overestimating readers' digital skills, regardless of the readers' level of education. Just because one can e-read does not necessarily mean that one e-reads well or successfully.

Academic reading is purpose-driven and requires specialized skills to successfully negotiate the demands of completing a given task. This includes potentially learning and employing new kinds of strategies to successfully utilize different reading modes. It behoves instructors and/or educational institutions to be mindful through continuous observation of EAL learners' strategic behaviour, paying attention to reading comprehension performance, and evaluating what behaviours more successful readers exhibit that less successful readers do not. Incorporating into curricula specialized training in strategic e-reading would be valuable, as the skills needed between paper-based reading and e-reading appear to be mismatched (Akyel & Erçetin, 2009; Chou, 2011; Mangen et al., 2013), and it can take time for readers to get used to employing new strategies before they are used effectively in reading tasks (Veloo, Rani, & Hashim, 2015).

Furthermore, this present study showed that the use of some individual studies can potentially be detrimental to reading success despite traditionally-held beliefs in pedagogy. Given that the paper reading group had a negative correlation between *using comprehension questions* – a common strategy taught in preparatory course for IELTS and TOEFL language examinations – and task performance, it is imperative for EAL

instructors to re-evaluate reading strategy instruction, and to take into account that the value lies not in which strategies are used, but how effectively EAL readers employ reading strategies, and that individual differences mean that no specific strategy will work for every language learner, particularly since strategy use in EAL language learning is largely task and context dependent (Huang, 2013a).

Acquiring the effective use of strategies to accomplish academic reading goals is an important skill, regardless of one's L1. To understand where strategies can be used most effectively for each reading modality, especially with regards to where (a) strategies may fall short in utility and (b) alternative strategies that can be used to compensate for these shortcomings, may potentially be a crucial step towards graduate reading success, particularly in situations where reading comprehension fails.

While there was a strong preference toward paper-based reading, both in general and for academic reading, EAL instructors across all contexts should be aware that this tendency may possibly be age-related and could easily (and quickly) change. With new generations being accepted into university, it is likely that younger students will have had a greater exposure to electronic reading. As such, there is a possibility that newer generations of EAL readers will exhibit more effective strategy use in their reading across both modes than we have found in this present study.

An unexpected discovery was the absence of L1 strategy use in the L2 reading process. While frequency appeared to be low, the use of the L1 is largely an internal process. Considering the complexity and difficulty for researchers to capture and collect non-observable data, given the advanced proficiency of the learners in this study, it may have been outside this study's power to ascertain to what extent the L1 contributed to L2

English academic reading strategy use. Much of the existing research describes the influence of the L1 over L2 performance (Guo, 2012; Huang, 2009), so it makes sense that the participants' mother tongue would play an equally important role. However, the combination of being graduate students in an English-speaking university, along with their advanced English language proficiency, could potentially be responsible for the reduced frequency of L1 strategy use in L2 reading, particularly since prolonged English exposure and the demands on reading proficiency to successfully negotiate academic demands may impact the extent to which one's L1 benefits or hinders success.

Age-related factors may also play a role in relation to the strong preference of reading on paper to e-reading. As the presence of e-reading becomes more and more prevalent from the foundation of reading acquisition up to post-graduate academic reading, pre-millenials may be the last generation to have acquired the ability to read solely through the use of paper-based materials. This was corroborated by one participant's survey remark in this study, stating how e-reading was not something done in school until moving to Canada for graduate school. Similar remarks have been made by other participants in previous studies (e.g., Foasberg, 2013). E-reading is still developing and evolving at a rapid pace, and with increasing technological innovations, preferences towards paper may change as (a) new innovations pave the way to strategic reading behaviour which maps similarly to what is used during paper-reading; or (b) as EAL readers develop specialized, effective e-reading strategies which, in turn, may improve their perceptions toward this reading modality.

5.3. Limitations

To my knowledge, this may be the first study of its kind to compare paper reading, e-reading without hypertext, and e-reading containing hypertext, strictly to EAL Chinese graduate students using three different sources of data. However, the results of this study should be interpreted with caution due to several factors identified in the following sub-sections.

5.3.1. Methodological Limitations

Sample size and research setting. The limited number of participants ($N = 26$) renders it impossible to generalize any of the findings in this study for two critical reasons: the overall sample size is too small to firmly establish normal distribution and thus, to use more robust parametric statistics, and all the participants in this study were recruited from the same university in western Canada. Such a small sample size may negatively influence the outcome of quantitative analyses such as MANOVA (Huang, 2013a), and the results may not be generalizable beyond the current research context.

The study took place in a research lab where all participants were under direct observation. This ostensibly cannot be equated to an authentic setting in which EAL readers would perform either (a) academic reading or (b) academic testing. The results might have been different if the task were performed without being under direct observation; i.e., if the research had taken place in a classroom, or if the types of reading tasks had been different.

Finally, the participants in this study were all graduate EAL Mandarin-speaking participants with high English language proficiency, who had recently successfully passed a high-stakes language examination. The findings from this present study should not be generalized to account for EAL readers from other ethnicities, with different

language proficiencies, or of different age categories, as it is possible that strategy use may vary across any (or all) of these variables.

Stimulated Recall. While stimulated recall has been acknowledged by Macaro (2006) as an acceptable and valid data collection method, there are a number of concerns with its employment in the field of EAL reading strategy research:

(1) Participants may not able to possibly report everything they think about while engaged in a reading task (Guo, 2012; Huang, 2014);

(2) Participants may report strategies in their verbal reports that in reality they may not have actually performed, or may have used to a greater or lesser extent than their verbal reports claim;

(3) Participants may decide to report only certain things about what they remember during their reading task because they believe and/or assume that said information is what the researcher expected in their performance;

(4) Stimulated recall could change participants' performances, in either positive or negative ways. The participants performed and reported their strategic behaviour with a heightened degree of conscientiousness than they otherwise would have while engaged in a real-world academic reading task, which could compromise the cognitive capacity otherwise dedicated to the task (Guo, 2012). Strategy research aims for authentic behaviour during performance; however, under direct supervision it is likely that their performances will be less natural than if left to their own devices (e.g., reading for pleasure, reading in a library) when engaged with an academic reading task.

(5) Finally, there is a strong possibility that ethnic dissimilarities between the participants and the researcher may have changed participants' performances. Although

all participants were offered the opportunity to conduct their verbal reports in either Mandarin or English, the verbal reports were given to me almost exclusively in English.[21] However, comparable research has shown that Chinese participants are highly likely to conduct their verbal reports in Chinese if the researcher is also Chinese (e.g., Guo, 2012; Huang, 2009, 2013b; Zhang, 2010). I may have impacted the participants' natural responses during the delivery of their verbal reports because my ethnicity differed from that of the participants. Their performance during the stimulated recall suggests that participants assumed I did not speak or understand Mandarin. While correct in this case, they neither knew nor asked about my language background. Had the participants performed their stimulated recall task in their L1 rather than in their L2, the kinds of strategies identified in their verbal reports may have differed (Huang, 2014).

Strategy Coding. While any intentions were for the best to ensure coding consistency between the coders through inter- and intra-coder reliability checks in the participants' observed performances, verbal reports, and survey data, there is still a chance that inconsistencies may exist with regards to strategy categorization in terms of individual strategy interpretation, operationalization, and so on (Huang, 2011).

Internal observation. The results of this study were based solely on external observation and reported performance. It was beyond the scope of this study to attempt to capture what was happening internally, and is thus of increasing concern that observing performance in conjunction with EAL readers' stimulated verbal reports may not provide an accurate map of what is occurring internally while academic reading is taking place (Huang, 2013a). For example, although Macaro (2006) claims stimulated recall reports to

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[21] Some verbal reports had Mandarin Chinese elements in them; however, when translated by my second coder, we found that there were no strategies in the L1 data.

be of "an acceptable level of validity and reliability" (p. 321), there is a growing likelihood that comparing neurological activity to verbal reports, rather than comparing what is seen to what is identified in the reports, would map a concurrent picture of strategic activity while academic reading tasks are underway, which would further empirically support Macaro's (2006) framework (Takeuchi, Ikeda, & Mizumoto, 2012).

Furthermore, what participants reported in the survey task and during the stimulated recall task was often an incomplete report of they were doing while they were reading. Observation was an important tool in identifying unreported strategies; however, very little strategic behaviour can be seen through observation alone, especially when it comes to reading, which shows (1) how internalized strategy use can be; and (2) how essential it is to use multiple methods of data collection in order to better understand the strategic processes that EAL readers are using.

5.3.2. Instrument Limitations

Reading Perception Survey. Although the instrument was field-tested during the pilot study and no concerns were found, the concerns with the utility of a survey in strategy research were not discovered until the main study, where it was found that the survey was unable to capture as much of the information as it aimed to collect. Huang (2013a) also remarked on the problematic issues underpinning the use of surveys in strategy research, as it can be difficult to ascertain whether or not a survey is able to effectively capture participants' perceptions and beliefs. This implies that the reliability of the results found through the use of a survey in strategy research may be questionable.

Main Reading Task. The reading task was problematic to the study for two minor reasons. First, although the reading task itself was of acceptable length and complexity,

there were insufficient comprehension questions available. A typical IELTS exams have numerous follow-up task questions which assess readers for comprehension on a variety of levels. This task only had four follow-up questions, which may not accurately reflect EAL readers' comprehension abilities, and may by extension limit the extent to which we can make empirical claims with regards to the relationship between strategy use and task performance. Lastly, the multiple demands on participants to complete all the instruments (i.e., reading task, stimulated recall report, reading perception survey) in this study may lead to participant fatigue.

5.4. Future Research Directions

The limitations presented through the discussion of this study's findings have created future opportunities to advance the current state of knowledge. Much of the data found in current strategy literature are based on frequency data and correlations rather than multivariate analyses, which seems to indicate that this type of research is an area within EAL reading strategy research which has been left unexplored until this study.

First, to expand upon the findings of this study, replication studies consisting of larger participant samples would assist in identifying significant trends among EAL readers that were restricted by this study due to the limited sample size and distribution, particularly in the area of statistical analysis. Larger samples are needed for future studies to reduce the chance of skewed results appearing in an otherwise valuable analysis, as the odds of achieving statistically significant results may increase, as well as strengthen the replicability of future results.

At present, the literature with regards to strategy use across contexts shows similar trends across language learning domains. This study and recent research have provided

evidence to suggest that the employment of strategies in reading and preferences towards specific reading modalities may differ greatly across tasks, contexts, and factors such as age, gender, and country where graduate education is taking place. Future studies should include comparisons of stimulated recall reports based on whether or not the researcher was a Mandarin speaker, or appeared to be of Chinese origin. A replication study with a Chinese researcher (or research assistant) would be helpful in determining whether or not the strategic behaviours reported in a given participant's stimulated recall report changes depending on the ethnic background (and perceived L1) of the researcher conducting the stimulated recall task.

The findings of this study may play a contributing role to future meta-analyses comparing various studies investigating the strategy use of different EAL reading groups across both EAL and EFL contexts. Meta-analysis would be helpful to address the question of how EAL instructors might better be able to address the needs of EAL readers in situations where their reading comprehension is lacking. Investigating potential differences in reading strategy use and modality preference across different age groups would be an insightful step forward.

Finally, it would be beneficial in future studies to investigate the use of a pre-task questionnaire to elicit EAL readers' general approach to performing a similar academic reading task, followed up using methods and instruments similar to this study. A pre-assessment instrument would be a worthwhile tool to examine differences between what EAL readers perceive themselves to be doing strategically while reading, what they do during their reading task performance, and what they report afterward. Such a study

would provide a wealth of awareness-raising to EAL students, which in turn could potentially influence future reading performances and/or strategy use.

5.5. Concluding Remarks

This study has attempted to capture the strategic behaviour of 26 Mandarin-speaking EAL graduate students when they engage in academic reading tasks, and to what extent there is a relationship between reading strategy use and task performance. Using three sources of data (i.e., observed, reported, and survey), I have found that graduate students use a wide array of individual strategies in a multitude of intentional ways, aimed at organizing, planning, evaluating, and ultimately achieving reading comprehension goals. Among the six categories of reading strategies identified in the data, the most used strategy category was cognitive, while the least used strategy category was social. The findings offer researchers, instructors, and learners about the types of strategies EAL graduate readers employ in academic reading, and how their strategy use plays a role in their reading performance.

The findings from this study also indicate that strategy use among EAL graduate readers can vary depending on perceptions and preferences of the reading mode they are using to perform the task. It is important to understand, however, that strategy use is task, context, and medium-dependent, and that explicit strategy instruction may not necessarily result in uniform reading success, as strategies can work for and against EAL readers depending on the various combinations in which they are employed. EAL researchers and instructors need to take into account the perceptions and preferences of their students, and how these perceptions might shape the way in which reading strategies are employed in reading tasks.

Results from the data analysis show several relationships between the use of strategies and task performance at the significant level. There was one overall positive relationship in the use of the cognitive strategy category and task performance across all participants. Two of the three reading groups also revealed statistically significant relationships between individual strategy use and task performance, with ONH showing one positive correlation, and the Paper group showing a mix of positive and negative associations in the use of individual approach and cognitive strategies. Such findings indicate that reading is a complex set of behaviours that may shift in frequency or type depending on the medium EAL readers employ. Furthermore, based on the results from the paper group, it is important for EAL instructors to be aware that the use of individual strategies may not always ensure successful comprehension of a given reading task. Despite the advanced language proficiency level of EAL graduate students, making assumptions that advanced language proficiency is tantamount to advanced reading proficiency may do a disservice to EAL learners, as strategy use is fluid, non-linear, and complex, and that minor adjustments may facilitate significant improvements to comprehension.

It is crucial that EAL researchers, instructors, and learners alike recognize the value and importance of reading strategies. While perception of a particular reading mode can often drive one’s reading modality preferences, the results of this study have indicated that reading preferences may not enhance reading task scores. Furthermore, the uniform application of strategies to various reading modalities may not positively benefit reading comprehension. It is important to be mindful that EAL reading strategy use is complex and nonlinear in nature, that effective employment of these strategies plays a key role in

successful reading performance, and that effective strategy employment may differ depending on which reading modality is being used in a given reading task.

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List of Appendices

Appendix A.
Recruitment Materials

i. Invitation to participate [E-mail, Facebook]

Hello,

I am conducting a study for my Master's degree investigating the reading comprehension strategies of L1 Mandarin Chinese graduate students while engaged in reading English materials, and the unique use of these reading comprehension strategies in three different types of reading media: traditional (i.e., paper-based), electronic without the presence of embedded text links, and electronic with the presence of embedded text links. I am looking for graduate students whose mother tongue and ethnic background is Mandarin Chinese, and who are currently enrolled at the University of Victoria. Participation in this research will take approximately 80-85 minutes over the course of two sessions.

If you are interested, please contact me via private message [for Facebook only], e-mail (hillcj@uvic.ca), or phone (250-885-5596). Also, if you know anyone else who may be interested and meets the criteria for participation, please feel free to give them my contact information. Please DO NOT respond by commenting on this post [For Facebook only].

Looking forward to hearing from you, and thank you in advance for your time and involvement!

Carrie

ii. Recruitment Poster

Are you a Mandarin Chinese graduate student currently enrolled at UVic?

YOU ARE INVITED TO PARTICIPATE IN A UNIQUE RESEARCH PROJECT ABOUT READING!

- Learn about your own reading strategies!
- Learn about your reading preferences!

For More Information, Please contact Carrie at hillcj@uvic.ca or 250-885-5596

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hillcj@uvic.ca 250.885.5596

iii. Letter of Invitation via Graduate Secretaries

Subject: Request to Forward A Letter of Invitation to Your Graduate Students

Dear Graduate Secretaries,

My name is Carrie Hill. I am a Master's student in the Department of Linguistics here at the University of Victoria. I am currently conducting a research project as principal investigator to fulfill partial requirement for my Master of Arts degree in Linguistics. This study has received approval from the Human Research Ethics Board here at UVic. You can verify the ethical approval of this study by contacting the Research Ethics Office by phone at (250) 472-4545, or by email at ethics@uvic.ca.

I would be grateful if you could forward the attached letter of invitation to your graduate students for their consideration.

With thanks and best regards,
Carrie Hill

Dear Graduate Students,

If you speak **Mandarin as a first language** and **English as an additional language**, and you are a **Chinese student currently enrolled in a graduate program at the University of Victoria**, please consider participating in my Master's thesis research, titled *English-as-an-additional-language reading strategy use: An investigation of readers' strategic behaviour when using paper-based and electronic materials in academic reading tasks.*

Please feel free contact me at your earliest convenience if you are interested in participating in my research. I will provide you with a letter of information for your records in advance and would be happy to answer any questions you might have, prior to

and/or during your participation in this investigation. I am available by phone at (250) 885-5596 and by e-mail at hillcj@uvic.ca.

I look forward to hearing from you.

Sincerely,

Carrie Hill

M.A. Candidate
Principal Investigator
Department of Linguistics
University of Victoria

iv. Letter of Information

Letter of Information

English-as-an-additional-language reading strategy use: An investigation of readers' strategic behavior when using paper-based and electronic materials in academic reading tasks

You are invited to participate in a research study entitled "English-as-an-additional-language reading strategy use: An investigation of readers' strategic behavior when using paper-based and electronic materials in academic reading tasks" that is being investigated by Carrie Hill.

Carrie Hill is a graduate student in the department of Linguistics at the University of Victoria and you may contact her if you have further questions by email at hillcj@uvic.ca.

As a graduate student, I am required to conduct research as part of the requirements for a Master's degree in Applied Linguistics. It is being conducted under the supervision of Dr. Li-Shih Huang. You may contact my supervisor at (250) 472-4665.

Purpose and Objectives
The purpose of this research project is to examine English-as-an-additional learners' (EAL) reading strategy use in paper-based and e-reading tasks, with and without the incorporation of embedded links, to describe the processes and strategic behavior used by different reading groups.

Importance of This Research
Research of this type is important because current literature has graduate EAL students in the area of reading research, and it is critical to understand the strategies that graduate EAL students use to comprehend what they are reading in order to provide better support in accordance with their unique reading needs.

Participants Selection
You are being asked to participate in this study because you are a Mandarin Chinese person, have intermediate-level or above English reading competence, and are currently enrolled in the University of Victoria's graduate program.

What is Involved
If you consent to voluntarily participate in this research, your participation will include coming to 2 sessions [80-85 minutes] where you will fill out a consent form, background questionnaire, engage in academic reading tasks either on paper or on a computer, answer comprehension questions immediately following these tasks, and report what strategies you used to understand what you have read. Following this, you will complete a

preference survey based on your experience with paper-based reading or electronic reading. Audio-tapes and digital video recording will be involved in the data collection sessions. The video recordings will not be seen by anyone other than the principal investigator (Carrie Hill) at any time.

Inconvenience
Participation in this study may cause some inconvenience to you, including spending 80-85 minutes of time over the course of two research sessions to first practice and then engage with academic tasks

Risks
There are minimal risks to you by participating in this research, which may include possible fatigue or stress due to the nature of the research being conducted. To prevent or to deal with these risks, participants may take a break on request if fatigue or stress occurs. Beverages and snacks will be available to increase the participants' level of comfort during their sessions.

Benefits
The potential benefits of your participation in this research include learning about your own personal reading strategies and preferences, and discovering the unique language learning needs that you engage in during reading tasks which set you apart from other university student demographics (e.g., undergraduate students). Your participation will also contribute to determining the extent to which language instructors are meeting graduate students' academic reading needs.

Compensation
As a way to compensate you for any inconvenience related to your participation, you will be provided with beverages and refreshments during each session, and will be given a $5 gift card towards the UVic bookstore at the end of the participation period. If you consent to participate in this study, this form of compensation to you must not be coercive. It is unethical to provide undue compensation or inducements to research participants. If you would not participate if the compensation was not offered, then you should decline.

Voluntary Participation
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any questions, consequences or explanation. If you do withdraw from the study your data will be destroyed and will not be used in the study.

On-going Consent
To make sure that you continue to consent to participate in this research, I will explain at the preliminary session that there are two visits required to complete the investigation, and will have you re-read and sign the consent form at the beginning of the second and final session. The data collected from you may be used in future research.

Anonymity
In terms of protecting your anonymity, due to your ethnic background and language background anonymity may potentially be limited. You will not be anonymous during the data collection phase of the research. However, your identity will not be revealed to anyone during the course of the investigation, nor when I share the results of this investigation in future publications and/or scholarly conferences.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected through the use of pseudonyms and coding sheets, and by securing all revealing information in a password-protected computer file contained in a password-protected flash drive and an external hard drive securely located at the investigator's home residence.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the following ways: Graduate thesis, presentations at scholarly conferences, class presentations, and published articles.

Disposal of Data
Data from this study will be disposed 5 years after completion of this research project. Data will be archived on a password-protected external hard drive and securely filed on the investigator's home computer, located at her home residence.

Contacts
Individuals that may be contacted regarding this study include my supervisor, Dr. Li-Shih Huang, at (250) 472-4665.

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Please retain a copy of this letter for your reference.

Appendix B.
Consent to Participate

University of Victoria

Consent Form

English-as-an-additional-language reading strategy use: An investigation of readers' strategic behaviour when using paper-based and electronic materials in academic reading tasks

You are invited to participate in a research study entitled "English-as-an-additional-language reading strategy use: An investigation of readers' strategic behaviour when using paper-based and electronic materials in academic reading tasks" that is being investigated by Carrie Hill.

Carrie Hill is a graduate student in the department of Linguistics at the University of Victoria and you may contact her if you have further questions by email at hillcj@uvic.ca.

As a graduate student, I am required to conduct research as part of the requirements for a Master's degree in Applied Linguistics. It is being conducted under the supervision of Dr. Li-Shih Huang. You may contact my supervisor at (250) 472-4665.

Purpose and Objectives
The purpose of this research project is to examine English-as-an-additional learners' (EAL) reading strategy use in paper-based and e-reading tasks, with and without the incorporation of embedded links, to describe the processes and strategic behaviour used by different reading groups.

Importance of This Research
Research of this type is important because current literature has graduate EAL students in the area of reading research, and it is critical to understand the strategies that graduate EAL students use to comprehend what they are reading in order to provide better support in accordance with their unique reading needs.

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You are being asked to participate in this study because you are a Mandarin Chinese person, have intermediate-level or above English reading competence, and are currently enrolled in the University of Victoria's graduate program.

What is Involved
If you consent to voluntarily participate in this research, your participation will include coming to 2 sessions [80-85 minutes] where you will fill out a consent form, background questionnaire, engage in academic reading tasks either on paper or on a computer, answer

comprehension questions immediately following these tasks, and report what strategies you used to understand what you have read. Following this, you will complete a preference survey based on your experience with paper-based reading or electronic reading. Audiotapes and digital video recording will be involved in the data collection sessions. The video recordings will not be seen by anyone other than the principal investigator (Carrie Hill) at any time.

Inconvenience
Participation in this study may cause some inconvenience to you, including spending 80-85 minutes of time over the course of two research sessions to first practice and then engage with academic tasks

Risks
There are minimal risks to you by participating in this research, which may include possible fatigue or stress due to the nature of the research being conducted. To prevent or to deal with these risks, participants may take a break on request if fatigue or stress occurs. Beverages and snacks will be available to increase the participants' level of comfort during their sessions.

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The potential benefits of your participation in this research include learning about your own personal reading strategies and preferences, and discovering the unique language learning needs that you engage in during reading tasks which set you apart from other university student demographics (e.g., undergraduate students). Your participation will also contribute to determining the extent to which language instructors are meeting graduate students' academic reading needs.

Compensation
As a way to compensate you for any inconvenience related to your participation, you will be provided with beverages and refreshments during each session, and will be given a $5 gift card towards the UVic bookstore at the end of the participation period. If you consent to participate in this study, this form of compensation to you must not be coercive. It is unethical to provide undue compensation or inducements to research participants. If you would not participate if the compensation were not offered, then you should decline.

Voluntary Participation
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any questions, consequences or explanation. If you do withdraw from the study your data will be destroyed and will not be used in the study.

On-going Consent
To make sure that you continue to consent to participate in this research, I will explain at the preliminary session that there are two visits required to complete the investigation, and will have you re-read and sign the consent form at the beginning of the second and final session. The data collected from you may be used in future research.

Anonymity
In terms of protecting your anonymity, due to your ethnic background and language background anonymity may potentially be limited. You will not be anonymous during the data collection phase of the research. However, your identity will not be revealed to anyone during the course of the investigation, nor when I share the results of this investigation in future publications and/or scholarly conferences.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected through the use of pseudonyms and coding sheets, and by securing all revealing information in a password-protected computer file contained in a password-protected flash drive and an external hard drive securely located at the investigator's home residence.

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Contacts
Individuals that may be contacted regarding this study include my supervisor, Dr. Li-Shih Huang, at (250) 472-4665.

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this research project.
Session 1:

____________________	____________________	__________
Name of Participant	*Signature*	*Date*

Session 2:

____________________	____________________	__________
Name of Participant	*Signature*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix C.
Session One Reading Task

Identifying information: "The Motor Car"

Source: http://ielts.org/PDF/115013_academic_reading_sample_task_-_identifying_information__2_.pdf

1. There are now over 700 million motor vehicles in the world - and the number is rising by more than 40 million each year. The average distance driven by car users is growing too - from 8km a day per person in western Europe in 1965 to 25 km a day in 1995. This dependence on motor vehicles has given rise to major problems, including environmental pollution, depletion of oil resources, traffic congestion and safety.

2. While emissions from new cars are far less harmful than they used to be, city streets and motorways are becoming more crowded than ever, often with older trucks, buses and taxis which emit excessive levels of smoke and fumes. This concentration of vehicles makes air quality in urban areas unpleasant and sometimes dangerous to breathe. Even Moscow has joined the list of capitals afflicted by congestion and traffic fumes. In Mexico City, vehicle pollution is a major health hazard.

3. Until a hundred years ago, most journeys were in the 20km range, the distance conveniently accessible by horse. Heavy freight could only be carried by water or rail. Invention of the motor vehicle brought personal mobility to the masses and made rapid freight delivery possible over a much wider area. In the United Kingdom, about 90 per cent of inland freight is carried by road. The world cannot revert to the horse-drawn wagon. Can it avoid being locked into congested and polluting ways of transporting people and goods?

4. In Europe most cities are still designed for the old modes of transport. Adaptation to the motor car has involved adding ring roads, one-way systems and parking lots. In the United States, more land is assigned to car use than to housing. Urban sprawl means that life without a car is next to impossible. Mass use of motor vehicles has also killed or injured millions of people. Other social effects have been blamed on the car such as alienation and aggressive human behaviour.

5. A 1993 study by the European Federation for Transport and Environment found that car transport is seven times as costly as rail travel in terms of the external social costs it entails - congestion, accidents, pollution, loss of cropland and

natural habitats, depletion of oil resources, and so on. Yet cars easily surpass trains or buses as a flexible and convenient mode of personal transport. It is unrealistic to expect people to give up private cars in favour of mass transit.

6. Technical solutions can reduce the pollution problem and increase the fuelled efficiency of engines. But fuel consumption and exhaust emissions depend on which cars are preferred by customers and how they are driven. Many people buy larger cars than they need for daily purposes or waste fuel by driving aggressively. Besides, global car use is increasing at a faster rate than the improvement in emissions and fuel efficiency which technology is now making possible.
7. Some argue that the only long-term solution is to design cities and neighbourhoods so that car journeys are not necessary - all essential services being located within walking distance or easily accessible by public transport. Not only would this save energy and cut carbon dioxide emissions, it would also enhance the quality of community life, putting the emphasis on people instead of cars. Good local government is already bringing this about in some places. But few democratic communities are blessed with the vision – and the capital – to make such profound changes in modern lifestyles.
8. A more likely scenario seems to be a combination of mass transit systems for travel into and around cities, with small 'low emission' cars for urban use and larger hybrid or lean burn cars for use elsewhere. Electronically tolled highways might be used to ensure that drivers pay charges geared to actual road use. Better integration of transport systems is also highly desirable - and made more feasible by modern computers. But these are solutions for countries which can afford them. In most developing countries, old cars and old technologies continue to predominate.

Questions 14 – 19

Sample Passage 7 has eight paragraphs labelled **1-8.** Which paragraphs contains the following information?

*Write the correct letter **1-8** in boxes 14-19 on your answer sheet. **NB** You may use any letter more than once.*

14 a comparison of past and present transportation methods

15 how driving habits contribute to road problems

16 the relative merits of cars and public transport

17 the writer's prediction on future solutions

18 the increasing use of motor vehicles

19 the impact of the car on city development

Appendix D.
Session Two Reading Task

Identifying writers views/claims:
"The Risks of Cigarette Smoke"

Source: **http://ielts.org/pdf/115014_Academic_Reading_sample_task_-_Identifying_writer_s_views__2_.pdf**

1. Discovered in the early 1800s and named 'nicotianine', the oily essence now called nicotine is the main active ingredient of tobacco. Nicotine, however, is only a small component of cigarette smoke, which contains more than 4,700 chemical compounds, including 43 cancer-causing substances. In recent times, scientific research has been providing evidence that years of cigarette smoking vastly increases the risk of developing fatal medical conditions.

2. In addition to being responsible for more than 85 per cent of lung cancers, smoking is associated with cancers of, amongst others, the mouth, stomach and kidneys, and is thought to cause about 14 per cent of leukemia and cervical cancers. In 1990, smoking caused more than 84,000 deaths, mainly resulting from such problems as pneumonia, bronchitis and influenza. Smoking, it is believed, is responsible for 30 per cent of all deaths from cancer and clearly represents the most important preventable cause of cancer in countries like the United States today.

3. Passive smoking, the breathing in of the side-stream smoke from the burning of tobacco between puffs or of the smoke exhaled by a smoker, also causes a serious health risk. A report published in 1992 by the US Environmental Protection Agency (EPA) emphasized the health dangers, especially from side-stream smoke. This type of smoke contains more smaller particles and is therefore more likely to be deposited deep in the lungs. On the basis of this report, the EPA has classified environmental tobacco smoke in the highest risk category for causing cancer.

4. As an illustration of the health risks, in the case of a married couple where one partner is a smoker and one a non-smoker, the latter is believed to have a 30 per cent higher risk of death from heart disease because of passive smoking. The risk of lung cancer also increases over the years of exposure and the figure jumps to 80 per cent if the spouse has been smoking four packs a day for 20 years. It has been calculated that 17 per cent of cases of lung cancer can be attributed to high levels of exposure to second-hand tobacco smoke during childhood and adolescence.

5. A more recent study by researchers at the University of California at San Francisco (UCSF) has shown that second-hand cigarette smoke does more harm to non-smokers than to smokers. Leaving aside the philosophical question of whether anyone should have to breathe someone else's cigarette smoke, the report suggests that the smoke experienced by many people in their daily lives is enough to produce substantial adverse effects on a person's heart and lungs.

6. The report, published in the Journal of the American Medical Association (AMA), was based on the researchers' own earlier research but also includes a review of studies over the past few years. The American Medical Association represents about half of all US doctors and is a strong opponent of smoking. The study suggests that people who smoke cigarettes are continually damaging their cardiovascular system, which adapts in order to compensate for the effects of smoking. It further states that people who do not smoke do not have the benefit of their system adapting to the smoke inhalation. Consequently, the effects of passive smoking are far greater on non-smokers than on smokers.

7. This report emphasizes that cancer is not caused by a single element in cigarette smoke; harmful effects to health are caused by many components. Carbon monoxide, for example, competes with oxygen in red blood cells and interferes with the blood's ability to deliver life-giving oxygen to the heart. Nicotine and other toxins in cigarette smoke activate small blood cells called platelets, which increases the likelihood of blood clots, thereby affecting blood circulation

throughout the body.

8. The researchers criticize the practice of some scientific consultants who work with the tobacco industry for assuming that cigarette smoke has the same impact on smokers as it does on non-smokers. They argue that those scientists are underestimating the damage done by passive smoking and, in support of their recent findings, cite some previous research which points to passive smoking as the cause for between 30,000 and 60,000 deaths from heart attacks each year in the United States. This means that passive smoking is the third most preventable cause of death after active smoking and alcohol-related diseases.

9. The study argues that the type of action needed against passive smoking should be similar to that being taken against illegal drugs and AIDS (SIDA). The UCSF researchers maintain that the simplest and most cost-effective action is to establish smoke-free work places, schools and public places.

Questions 4 – 7

Do the following statements reflect the claims of the writer in the reading passage?

In boxes 4-7 on your answer sheet write ***YES*** ***NO*** ***NOT GIVEN***

- *If the statement reflects the claims of the writer*
- *If the statement contradicts the claims of the writer*
- *If it is impossible to say what the writer thinks about this*

4. Thirty percent of deaths in the United States are caused by smoking-related diseases.
5. If one partner in a marriage smokes, the other is likely to take up smoking.
6. Teenagers whose parents smoke are at risk of getting lung cancer at some point during their lives.
7. Opponents of smoking financed the UCSF study.

Appendix E.
Reading Perception Survey

Preferences

1. How many hours per day do you spend reading in English?
2. How many hours per day do you spend reading in your mother tongue?
3. How many hours per day spent reading English are spent reading on paper?
4. What percentage of the English reading you do per day is spent e-reading?
5. Do you use handheld electronic devices such as iPhone, Kindle, Kobo, iPad, when reading in English?
   --- If yes, please answer the following questions:
   1. Approximately how many hours per week do you spend reading using this technology?
   2. Do you ever switch from reading something online to reading the same thing on paper before you have completed reading the material online? What are your reasons for switching from reading online to reading on paper?
   3. Do you ever switch from reading something on paper to reading the same thing online before you have completed reading the material on paper? What are your reasons for switching from reading on paper to reading online?
6. To what extent do you print out readings without reading them online? Explain why you print out readings.
7. To what extent do you read online without printing the material out? Explain why you choose to e-read.
8. Do you feel that you perform better while reading paper-based tasks or while e-reading? Explain.
9. Do you feel that you remember things more clearly while reading on paper or while e-reading? Explain.
10. Do you prefer reading on paper or e-reading? Explain your reasons in detail.

[Paper-based reading only]

1. When you are approaching a reading task on paper, what are some strategies you use to prepare yourself for completing the task? Explain how you decide to navigate through reading tasks.
2. Describe what steps you go through to concentrate productively during a reading task.
3. Describe what steps you go through to understand unfamiliar words or concepts during a reading task.

[E-reading (no hypertext) only]

1. When you are approaching an e-reading task, what are some strategies you use to prepare yourself for completing the task? Explain how you decide to navigate through reading tasks.
2. Describe what steps you go through to concentrate productively during a reading task.
3. Describe what steps you go through to understand unfamiliar words or concepts during a reading task.

[E-reading (with hypertext) only]

1. When you are approaching an e-reading task, what are some strategies you use to prepare yourself for completing the task? Explain how you decide to navigate through reading tasks using hypertext.
2. Explain how you decide to navigate through reading tasks using hypertext.
3. Do you feel that embedded links (i.e., hypertext) benefit your reading? Explain.
4. What are some challenges you face when e-reading with hypertext? Explain in detail.

Appendix F.
Task and Stimulated Recall Scripts

A. Instructions for the researcher to keep in mind while conducting the stimulated recall sessions:

1. Make the participant feel comfortable.
2. Explain the purpose of the session.
3. Provide instructions about what the participant is expected to do.
4. Ensure that the video camera is working.
5. Do not direct the participant's responses. Do not go beyond "What were you thinking?"
6. If the response is that he/she does not remember, do not pursue the matter.
7. Do not provide definite reactions to participants' responses. Use back-channelling or non-responses, such as "oh, I see," "okay," "uh-huh," etc.
8. Pause the recording when the participant is talking during playback.

B. Task script

In this study, I am interested in learning what you think about as you carry out the reading task administered [on your handout | on the computer screen]. To do this, I am going to first record you during the reading task. After you complete the task, I am going to play back the video clip and ask you to think aloud. By "think aloud," I mean that I want you to recall and say out loud everything that came into your mind before, during, and after you completed the task. It is important that you do not plan or try to explain to me what you are thinking, and it is important that you keep talking. You may speak in English or in Mandarin, whichever comes naturally to you when you are recalling the thoughts you had before, during, and after completing the reading task. It is important

that you keep talking in English or in Mandarin. If you are silent for any period of time, I will remind you to keep talking.

[*Session two only*]: Please treat this as a real test. You will have 25 minutes to complete the reading task, including answering the questions.

Do you understand what I am asking you to do? Do you have any questions?

[-task recording/completion period-]

C. Stimulated recall script

Now we are going to watch the video clip of you performing the task. I'd like you to tell me what you were thinking before, during, and after you completed the task. I am interested in what was in your mind as early as when you began the task up until the time that you completed the task. Please do not think about what you think you may have done or should have thought or done. I do not want you to try to perform the reading task again. Here is how you pause the video. If you want to tell me something about what you were thinking, you can pause at any time. If I have a question about what you were thinking, I will pause and ask you to clarify that part of the video. Please go ahead and tell me what you can remember.

D. Possible questions to ask during the stimulated recall session if verbal reports pause for longer than five seconds:

1. What were you thinking here at this point?
2. What were you thinking just then?
3. Can you tell me what you were thinking at that point?
4. I see you appear ______. What were you thinking then?

5. I see you are ________. What were you thinking then?
6. Is there anything else that comes to your mind?
7. Do you remember thinking anything when…?
8. Can you remember thinking anything when…?
9. I noticed you are doing _____ (e.g., writing on the handout). Can you tell me what you were doing or what you were thinking about at this time?
10. What were you thinking before you started the task?
11. How did you go about preparing for this task?
12. What did you think about after you completed the task?
13. How were you feeling during this task?

Appendix G.
EAL Reading Coding Scheme

	Individual Strategies	Definition	Example[22]
Approach: Involving what the test-taker/reader does to orient him- or herself to the task	*Developing reasons*	Test-taker/reader offering explanations for doing what he/she does during his/her performance	PR: "I gave the answer immediately in the marriage because definitely it's not logic – it doesn't logically follow that the other one would take up this habit."
	Generating ideas	Test-taker/reader generating ideas	PR: "So I think like maybe I need to find some uh, numbers, uh, maybe it's uh, critical to the questions.
	Identifying task format	Test-taker/reader trying to figure out the format of the reading task	PR: "I find that maybe this is the link to [IELTS], it's from an English test. So I'm thinking this is regular uh, article for the test. Clearly they have a specific uh, structure and usually they will ask questions.
	Identifying task purpose	Test-taker/reader trying to figure out the purpose of the reading task	OR: Scanning the reading material, then going to the end of the task to note the comprehension questions
	Making choices	Test-taker/reader cognitively engaging in purposeful decision-making during the reading task	PR: "I tried to find keywords such as 'teenagers' and 'opponents'. If I can't find them maybe I will just give the answer a 'not given'. If I can find them I will answer it.
	Using	Test-taker/reader looks at the	PR: "I first go to the question, give

[22] Note: OR = Observed report; PR = Participants' report

	comprehension questions	comprehension questions before orienting him/herself to the reading task	me an idea of what I need to focus on… give me a goal for reading."
Achievement: Involving conscious plans for solving comprehension problems in order to reach a comprehension goal	**Individual Strategies**	**Definition**	**Example**
	Abandoning	Test-taker/reader abandoning subject matter during the task	PR: "Because the last few paragraphs are all talking about second-hand smoking, I quickly skipped some sentences of them… want to get to the question part."
	Adjusting hardware	Test-taker/reader adjusting position or spatial distance of the computer to engage in the task	OR: Repositioning the space between the test-taker/reader and the computer; adjusting the position of the monitor
	Anticipating task length	Test-taker/reader anticipating the length of the reading task prior to reading	PR: "I just scan the whole passage first…I can have idea how long the passage would be and how many paragraphs it had."
	Anticipating task type	Test-taker/reader anticipating the type of task he/she will be engaging in	PR: "I had an assumption that I'm going to read an article about scientific research or something like that."
	Approximating	Test-taker/reader using lexical or grammatical knowledge to approximate meanings	PR: "I don't care to get the exact meaning of words. I think it's just similar to something, I cannot understand, but it's something. It's enough for me."
	Avoiding	Test-taker/reader thinking about avoiding areas that pose linguistic difficulties	PR: "There are lots of words related to chemistry. But I don't think I need to understand them. You only need to

			know they are chemicals, or maybe they are harmful chemicals, and that's all you need to know."
	Chunking	Test-taker/reader dividing sections of text into meaningful chunks	PR: "I use a dash… because the slash sometime just separates a chunk of information or a sentence… it can help me to, easier to, locate later on."
	Guessing	Test-taker/reader guessing by using linguistic or other cues	PR: "In this exercise maybe I didn't find that structure. Or maybe I lost track. So first of all I guessed the answer."
	Highlighting (enlarging text)	Test-taker/reader enlarging words or phrases in the task	OR: Using the software's tools to change the size of words or phrases in the text
	Highlighting (text colour)	Test-taker/reader changing the text colour of words or phrases	OR: Using the software's highlight function to change the colour of words or phrases
	Highlighting (w/ cursor)	Test-taker/reader using cursor to temporarily highlight small sections of text	OR: Using the cursor to highlight words or phrases, but not applying the software's highlight function
	Highlighting (underlining)	Test-taker/reader using cursor or mechanical means to underline specific sections of text	OR: Using the underline function to underline words or phrases in the text
	Linking	Test-taker/reader making connections between his/her previous knowledge or experience and what he/she is reading	PR: "… My brother smokes, so how about his family – will they be adversely affected? And I was going through that, actually connecting that to my own life."
	Linking to previous training	Test-taker/reader making connections between	PR: "I have taken some training courses in China, so the teacher gave

		his/her previous training and what he/she is reading	me some tips for doing reading. Today I just do the tips, and also there is some experience when I practice the reading. So I think this compilation of what I learned and experienced to help practice."
	Referring to notes	Test-taker/reader referring to notes made during the reading task	PR: "Usually I already take notes… should be easy. I go back to find the answer."
	Referring to questions	Test-taker/reader referring to the reading task questions	OR: Reading a paragraph, immediately scrolling to specific comprehension question(s), then returning to the same reading section previously viewed
	Repeating	Test-taker/reader repeating sections of task	PR: "When I see the questions, I found, oh! They want the details! And I have to go back to [the passage].
	Slowing down	Test-taker/reader slowing down the speed of reading for comprehension purposes	PR: "The third question's talking about teenagers… My reading speed is slower than before."
	Using L1	Test-taker/reader using L1	OR: Writing Chinese notes in the text margins
Cognitive: Involving manipulating the target language in order to understand or produce language	**Individual Strategies**	**Definition**	**Example**
	Analyzing linguistic choices	Test-taker/reader analyzing different linguistic choices for response	PR: "…This verb is really not correct use, so it should be deemed as wrong… If we change one of the uh for example subject, or verb, or object in the sentence, can we say it is

			wrong? Or it is not given?"
	Analyzing questions	Test-taker/reader analyzing task questions	PR: "But when I do those detailed questions, I feel that's tricky…"
	Anticipating questions	Test-taker/reader anticipating the question	PR: "There must be at least one yes, one no, one not given. So three of the answers must show up."
	Attending	Test-taker/reader deliberately directing his/her attention to a particular section of the task	OR: Directing attention for more than 2-3s on a particular section of the reading task. Moving to the section is a purposeful action requiring scrolling beyond 1-2 lines of text.
	Attending questions	Test-taker/reader directing his/her attention to task questions	OR: Focusing attention on task questions for a duration 3-5s or longer
	Attending to task content	Test-taker/reader directing his/her attention to the content of the task	PR: "I want to know where the number shows up… I tried to compare the sentence and the question…"
	Attending to task requirements	Test-taker/reader directing his/her attention to the requirements of the task	PR: "It is important to know the goal of the reading."
	Attending w/ cursor	Test-taker/reader using the computer mouse to achieve comprehension goal(s)	OR: Using the cursor to mark an area that is being read
	Attending w/ cursor (hovering)	Test-taker/reader using the computer mouse to attend to a section of text, line by line	OR: Hovering the mouse over text to focus, line by line
	Attending w/ pen	Test-taker/reader using his/her pen to focus attention to a specific section of the task	OR: Using a pen to guide reading by deliberately pointing at specific sections of text

	Attending w/ pen (hovering)	Test-taker/reader using a pen to hover over specific lines of text	OR: Using the pen to guide what is being read, line by line
	Directing search	Test-taker/reader using available internal tools to quickly search for missed information in the text	OR: Using searching functions within the software to navigate to specific parts of text
	Inferring	Test-taker/reader seeking to understand by using information in the text to guess the meanings of linguistic terms or to make up missing information	PR: "Some questions I cannot figure out because maybe the article didn't provide the specific information. But maybe we can deduce, like, we can maybe uh, get the answer from the information in the article."
	Making predictions	Test-taker/reader making predictions about the outcome of his/her performance	PR: "I was thinking that, if I get the whole picture [by reading carefully], then maybe my answer will be more accurate."
	Memorizing	Test-taker/reader memorizes words to pay attention to while reading	PR: "I try to remember these keywords and I…read."
	Recalling what was read	Test-taker/reader thinking about what he/she has read	PR: "When I see the details, when I read the text, I was not aware of details… I might recall a certain figures."
	Skimming	Test-taker/reader skimming the text to gain a general idea of the reading task, or to achieve a reading goal	PR: "Because it is a reading task, so first I have to have a review of this passage."
	Translating	Test-taker/reader translating between languages	PR: "Because if I wrote Mandarin words, I would translate from the passage to another language; it would cost some time or inaccuracy. So I

			think it's better to write in English, not Mandarin."
	Using context cues	Test-taker/reading using cues taken from the context in order to understand an unfamiliar word or concept	PR: "Sometimes I cannot remember the content. I need to get back to the sentence previously, or maybe two or three lines before to know what is the point I just read."
	Using intuition	Test-taker/reader using intuition in order to comprehend information	PR: "I can catch up, find the meaning for the words… use my common sense"
	Using keywords	Test-taker/reader using keywords to direct attention to what should be read	PR: "So I try to remember [keywords] and I begin to read. If the content has nothing to do with the keyword then I don't go to the details."
	Using mechanical means (chunking)	Test-taker/reader using mechanical means to divide sections of text into meaningful chunks	OR: Using markings to separate lines of text into smaller sections
	Using mechanical means (circling)	Test-taker/reader using mechanical means to circle words or phrases perceived as meaningful	OR: Circling words or phrases in the text
	Using mechanical means (making notes)	Test-taker/reader using mechanical means to make notes	OR: Writing notes down in the margin of the text
	Using mechanical means (misc. markings)	Test-taker/reader using mechanical means to make miscellaneous markings	OR: Writing symbols or miscellaneous marks in the margin of the text
	Using mechanical means (underlining)	Test-taker/reader using mechanical means to underline meaningful	OR: Underlining words, phrases, or lines of text

		units of text	
	Whispering	Test-taker/reader using audible sounds and/or mouthing words while reading	OR: Whispering audibly to ones' self while reading
Metacognitive: Involving organizing, planning, and evaluating	**Individual strategies**	**Definition**	**Example**
	Anticipating results	Test-taker/reader anticipating his/her task results	PR: "I am curious about the answers."
	Anticipating time used	Test-taker/reader anticipating how much time he or she used during the task	PR: *[When asked about thoughts after completing task]* "How much time did I use?"
	Attending to exam designer's conceptualization	Test-taker/reader attending to the exam designer's conceptualization of the task content	PR: "It seems that when you do this kind of exercise you are trying to figure out what the examination, I mean, the designers of this examination, are thinking about. So you are actually uh, not – you are trying to guess what they are thinking about and try to figure out what is correct – not actually from the text itself."
	Evaluating affect	Test-taker/reader evaluating his/her emotional state	PR: "I kind of relieved, oh, this almost the the end, possibly the conclusion to the paragraph."
	Evaluating language skills	Test-taker/reader evaluating language proficiency after completing a task	PR: "For me, to conduct the comprehensive task, uh, it's, it's more difficult for me to organize the information. If I'm reading in Chinese maybe it's easy for me to get the most important point and skip

			some detail."
	Evaluating mental process	Test-taker/reader evaluating his/her thinking process	PR: "I guess at that moment it should be similar as passive smoking…so because that's a little bit confusing for me at that moment."
	Evaluating performance	Test-taker/reader evaluating reading performance	PR: "I feel that [the performance] was not so successful because I'm probably wrong for the last question. So I don't feel it is a success."
	Evaluating previous training	Test-taker/reader evaluating the efficacy of his/her previous training on his/her task performance	PR: "I'm wondering if these so-called strategies in the market are affecting my choice. Because one of the strategies says that not given, this choice should not be the majority… in the true [and false] questions. So if I say this is not given, there would be two… which is probably not right."
	Evaluating rating criteria	Test-taker/reader evaluating the rating criteria of the task	PR: "When I do those detailed questions, I feel that's trickly and uh, to some extentif I get that questions wrong I only get 75% correct. I don't think it represents my comprehension of the whole text… I feel it's a little unfair because… the comprehension… all the questions correctly may not correspond to each other."
	Evaluating reading proficiency	Test-taker/reader evaluating his/her reading proficiency after completing a task	PR: "I believe that I can read, uh, pretty quickly, so I have sufficient time."

	Evaluating strategy use	Test-taker/reader evaluating the strategies used to perform the task	PR: "It's very hard for me to remember keywords in English, I thinks [*sic*]. I forgot to use it, so I had to back to the questions again. These notes seems, didn't work, didn't help me to enhance my comprehension."
	Evaluating task	Test-taker/reader evaluating the task	PR: "At first, I think this passage is a little harder than the text I read last week."
	Evaluating task format	Test-taker/reader evaluating the task format	PR: "You have to go up and down [the screen]. It's not convenient but I think for English I have to do this."
	Evaluating task questions	Test-taker/reader evaluating the questions found in the task	PR: "I'm not sure whether a yes/no question can satisfactorily cover those statements."
	Generating future solutions	Test-taker/reader generating solutions in response to their performance after a task	PR: "My capability of understanding is going backwards… I need to do more."
	Generating future strategies	Test-taker/reader generating strategies	PR: "After reading this passage, I would remind myself next time, try to be more careful about specific details... to memorize important details"
	Generating goals	Test-taker/reader generating goals	PR: "I think maybe I should keep hard working on English."
	ID problems	Test-taker/reader identifying problems in performing a task	PR: "I cannot grab the meaning of some paragraphs."
	Monitoring time	Test-taker/reader monitoring the time while performing a task	OR: Glancing at watch to see what time it is
	Planning	Test-taker/reader engaging in	PR: "'Not given' is quite confusing

		planning in order to perform a task	sometimes, it's hard to make decision, so I have that kind of feeling, should be careful with the 'not given' one."
	Reviewing	Test-taker/reader reviews the task content and applicable responses	PR: "I will provide possible answers for the questions, then I will check the answers, then I go back to the paragraph."
	Self-correction	Test-taker/reader self-correcting perceived performance errors in his/her comprehension	OR: Changing the answers to the comprehension questions
	Self-monitoring	Test-taker/reader self-monitoring his/her performance during a task	PR: "At beginning of the passage I read the headline to understanding what the author, what's the claim of the author. So I'm thinking how can I know the claim of the author?"
	Setting goal	Test-taker/reader setting a goal for task completion	PR: "I was reminded by the paper to read more."
Affective: Involving self-talk or mental control over affect	**Individual strategies**	**Definition**	**Example**
	Justifying affective state	Test-taker/reader using reasons to justify their emotions that might affect their performance	PR: "I didn't anticipate that they change to next topic. And it seems too hard for me to organize so many key words."
	Justifying performance	Test-taker/reader justifying his/her performance	PR: "It didn't mention anything about whether the partner will take up smoking or not, so I put not given."
	Justifying strategy use	Test-taker/reader justifying the use of his/her chosen strategies during the reading task	PR: "It is important to know the goal of the reading so this passage for me, I just need to know whether the

			fourth… is true or not. So I just used this strategy to deal with it."
	Monitoring affective state	Test-taker/reader monitoring his/her emotional state during the task	PR: "Actually I was not feeling tense until I read the questions, and then I see oh! I was not struggling until I read the questions."
Social: Involving interacting with the examiner/teacher in order to perform the task	**Individual strategies**	**Definition**	**Example[23]**
	Asking examiner questions	Test-taker/reader asking the examiner questions to determine how to perform task	R: Tell me what you were thinking about when you began reading. P: You mean, what came into my mind?
	Asking interlocutor for word meaning	Test-taker/reader asking the interlocutor to explain the meaning of a word	P: "Can I ask a question? What's the meaning of 'take up'?"
	Request external support	Test-taker/reader requesting the use of external tools for comprehension support	P: "Can I use my dictionary?"

[23] P = Participant; R = Researcher

Appendix H.
Qualitative Thematic Categories

Primary Category	Subcategory	Example
Value	Research	"Get basic ideas; briefly reading a large sum of papers to finding references for my own work"
	Interest	"If it is a book, I will purchase it is if it is really useful and interesting. If it is a paper, it must be useful to my research."
	Frequency of Use	"If the readings is often used, I would print it out and bring it with me."
Comfort	Unspecified/General	"Reading things on paper seems comfortable to me."
	Physical	"I prefer to read on paper since I feel it is helpful for my eyes."
	Mental	"For important papers I will print it out; I feel I have a better control over it"
	Familiarity	"Because I familiar with paper-base material for nearly 20 years."
Convenience	Unspecified/General	"It's convenient to search some specific contents when readings are quite a lot."
	Accessibility	"E-read is quick to get access to."
	Utility	"Generally, research papers I like to print out, because I can take notes on the paper easily."; "Electronic device is easy to carry."
	Efficiency	"Better efficiency, because of the freedom of re-organizing the content in a preferable layout"

	Focus	"Reading in paper is easier to focus [and make marks]."
	Cost	"I need to consider the printing fee."
Learning	Reading to learn/write	"Unless I need edit this material or find some related information on the Internet."
	Memory	"Reading on paper can help me remember some research articles information or something not really easy to understand. For some short paper like news or tweets, it's easier to use computer or iPhone to read. And those are easy to remember."
	Visual	"I'm a very visual person; as long as I see/read things in my eyes, I can understand/remember it."
	Performance	"I find myself read more quickly and understand better reading on paper."
	Task-oriented	"Only for writing a paper. I read the print-outs for highlights and quotes."
Other	Environment	"I do not want to print things out because it's more environmentally friendly [and cost-effective]."
	Pleasure	"English news something just for fun, I will choose to e-read."

Appendix I.
Qualitative Coding Results

	Paper		ONH		HT	
Primary Category	**Individual theme**	***n***	**Individual theme**	***n***	**Individual theme**	***n***
Value			Frequency of Use	2	Frequency of Use	2
	Interest	3	Interest	1	Interest	2
	Research	6	Research	4	Research	4
Convenience	Accessibility	6	Accessibility	10	Accessibility	8
	Cost	1	Cost	4	Cost	2
	Efficiency	1	Efficiency	4	Efficiency	2
	Focus	6	Focus	7	Focus	8
	Utility	16	Utility	14	Utility	12
	Unspecified/General	1	Unspecified/General	1	Unspecified/General	2
Comfort	Familiarity	5	Familiarity	5	Familiarity	3
	Mental	8	Mental	5	Physical	7
	Physical	12	Physical	8	Mental	3
	Unspecified/General	1	Unspecified/General	4		
Learning	Memory	5	Memory	5	Memory	3
	Performance	5	Performance	2	Performance	6
	Read/write	1	Task-oriented	6	Task-oriented	4
			Visual	1	Visual	1
Other	Environment	4	Pleasure	1	Environment	3
	Pleasure	1				
Total		82		84		72

Note. $N = 238$. Questions 5-7: $n = 120$; Questions 8-10: $n = 118$.