The influence of comprehension strategies on hypertext reading by students from non-English speaking backgrounds

Wang Hua

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Abstract

The inspiration to conduct the present study was the rapid spread of ICT use in the education sector. The aims of the study were to investigate the influence of a suite of reading comprehension strategies on hypertext comprehension by students’ from non-English speaking backgrounds (NESB); and to compare students’ hypertext comprehension performance when reading hypertexts with different structures.

Forty-nine participants took part in the experiment. The experiment had a pre-and-post-test design. The participants were randomly assigned into two different experimental groups. In the pre-test the first group was required to read a linearly-structured hypertext and answer some comprehension questions; the second group had to read a hierarchically-structured hypertext followed by questions to check their comprehension. After the pre-test, participants were given a five-week reading comprehension strategy training program. Cognitive strategies, metacognitive strategies and hypertext reading strategies were taught in the training program. Participants were given their post-tests after the training program. The present study employed a quantitative research method for data analysis. The results confirmed that NESB students’ hypertext comprehension performance had been enhanced after the reading comprehension strategy training. Also, the results showed that linearly structured hypertexts could lead to better comprehension performance than hierarchically structured hypertexts.

Based on the results of the study a teaching methodology of reading comprehension strategies for students from non-English speaking backgrounds was recommended. This particular teaching methodology could be incorporated into the blended-learning and/or e-learning context in the future.
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Declaration

I hereby declare that this thesis is the presentation of my original research work; and I am the sole author of it. It contains no material that has been accepted for the award to the candidate of any other degree or diploma. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public. The total number of words is under 100,000.

The work was done under the supervision of Dr. Elena Verezub and Dr. Matthew Mitchell, from Swinburne University of Technology.

Signature:

Wang Hua
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Chapter 1
Introduction

1.1 The background of and inspiration for conducting the present study

The advent of information and communication technologies (ICT) has largely influenced all sectors in the world, including the domain of education. For instance, Web 2.0 technologies and Web-based lecture technologies have been widely employed for educational purposes (Price & Kirkwood 2010). In fact, ICT has been widely used across all educational sectors in Australia, from primary education to post-graduate education. Primary schools have incorporated ICT into students’ reading programs (Watson & Hempenstall 2008). In secondary education, schools use ICT to enhance interactions amongst students and teachers (Hayes 2007). ICT is also widely employed at post-secondary levels in order to reduce the limitations of time and distance (Preston, Phillips, Gosper, McNeill, Woo & Green 2010). Thus, it has been asserted by many researchers that the application of ICT can enhance the teaching and learning experience, and performance. In this respect, the term technology enhanced learning is used to describe the involvement of ICT in education (Preston et al. 2010).

Specialists in education not only use ICT as a supplement, but have also started to incorporate ICT into traditional instructional activities. Thus, ICT is blended with conventional teaching and learning activities. This phenomenon is called blended learning. Blended learning is defined as “the thoughtful fusion of face-to-face and online learning experiences” (Garrison & Vaughan 2008, p.5). However, blended learning is not simply combining ICT with traditional teaching and learning activities. In order to deliver blended learning successfully, specialists in
education and ICT need to integrate face-to-face and online learning creatively, rethink curriculum design to maximise student engagement and restructure traditional class hours. In addition, educational institutions need to take into account students’ maturity, readiness and time management skills for blended learning. Moreover, blended learning demands students to take more control over their learning processes than pure face-to-face knowledge delivery.

Blended learning partially relies on ICT to present and/or deliver knowledge; however, e-learning entirely depends on ICT in terms of knowledge presentation and delivery, as well as interactions amongst teachers and students. The purposes of e-learning are as follows:

- To allow more students to engage in learning activities at a relatively low cost;
- To limit constraints of time and distance;
- To help learners keep a balance between learning, working and personal life;
- To cater for the diverse needs and expectations of students. (Kirkwood 2009)

The functions of e-learning include:

- Presenting materials and information online. Teachers are allowed to update and edit online information in a timely manner; while learners are able to access online information at any time;
- Increasing students’ engagement. E-learning enables students to take part in learning activities actively;
- Enhancing collaboration and communication amongst learners and teachers. Teachers and students exchange ideas via online communication and discussion. Moreover, students may be asked to
accomplish a task via online collaboration;

- Enabling students to create, store and retrieve online data in response to relevant activities as evidence of their experience and capabilities. (Kirkwood 2009)

In this respect, the present research study is inspired by the wide implementation of ICT in the domain of education. The study seeks to contribute a teaching methodology that teaches students to interact with online learning materials effectively, in the context of e-learning at a post-secondary education level.

One of key challenges for e-learning students is to comprehend online learning materials in order to obtain knowledge (Dunser & Jirasko 2005). In the context of e-learning, online learning materials consist of written texts, animations, audio clips and video clips. The present study focuses on exploring teaching students to comprehend online written texts successfully. In the present study, the term ‘hypertext’ is used to describe online written texts.

Hypertexts can be organised and presented in different structures, including a linear structure, a hierarchical structure, and a referential structure. Prior studies related to hypertext reading comprehension have paid substantial attention to exploring students’ navigating patterns and strategies while reading hypertexts with one particular structure (e.g. a hierarchical structure or a referential structure). Comparisons of hypertext comprehension performance brought by two different structures have seldom been mentioned. Thus, the present study aims at comparing students’ hypertext comprehension performance when reading hypertexts with linear and hierarchical structures.

Relevant literature has discussed difficulties brought up by disorientation, language barriers, as well as inappropriate interface design when students comprehend hypertexts. In particular, students from non-English speaking
backgrounds (NESB) may experience more difficulties than native English speaking students while comprehending hypertexts, given their diverse cultural backgrounds, language constraints, as well as their lack of prior knowledge of given topics (Tindale 2005a, b). Thus, it is argued that appropriate instructions on reading comprehension strategies can help NESB students to overcome potential challenges while reading hypertexts.

Prior studies have concluded that well-structured training or instruction of reading comprehension strategies can enhance students’ reading comprehension skills, while comprehending both conventional written texts and hypertexts. A number of previous studies (e.g. Lawrence 2007; Munro & Verezub 2011) have confirmed that teaching cognitive strategies to students could lead to their improved comprehension performance in both traditional print-based texts and hypertext contexts. Cognitive strategies are intellectual tools that assist readers in understanding texts.

Moreover, research findings in the last two decades have confirmed the importance of teaching students to comprehend texts metacognitively. Metacognition refers to mental activities that control what and how people process information and deal with different scenarios. It has been suggested that teaching students to apply metacognitive reading strategies can potentially enhance their reading comprehension performance while reading both traditional print-based texts and hypertexts. Hypertext reading strategies are critical for students to comprehend online texts, since hypertexts contain hyperlinks and could result in multi-sequence of reading. Multi-sequence of reading has been considered to be one potential difficulty that students may encounter while comprehending hypertexts.

Hypertext reading strategies do not only help readers select hyperlinks but also reduce the incidence of disorientation. Prior studies have highlighted the
importance of hypertext reading strategies for contemporary students (Sutherland-Smith 2002a, b). Although previous studies have confirmed the effects of reading strategy training on enhancing students’ hypertext reading comprehension performance, limited attention has been paid to NESB students’ knowledge of various reading comprehension strategies, and the application of such strategies. In this respect, the present study investigates the influence of reading comprehension strategy training on NESB students’ hypertext comprehension performance.

Overall, the present study explores the possibility of enhancing NESB students’ hypertext comprehension performance, by providing training activities associated with strategy instructions. The aims of the present study are as follows:

- To investigate the influence of reading strategy (including cognitive strategies, metacognitive strategies and hypertext reading strategies) training on NESB students’ hypertext comprehension performance;
- To compare NESB students’ hypertext comprehension while they read hypertexts with two different structures.

1.2 A brief overview of the present study

The present study employs a quantitative research method to investigate the effects of a reading strategy training program on NESB students’ hypertext comprehension performance, as well as comparing NESB students’ comprehension performance when comprehending hypertexts with linear and hierarchical structures. Students from non-English speaking backgrounds undertaking post-secondary business courses were recruited as participants. The present study had a pre-and-post-test design. In addition, five one-hour training sessions were given to participants on a weekly basis between the pre-and post-tests.
Participants were randomly assigned into two experimental groups. One group of participants read hypertexts with a linear structure, whereas the other read hierarchically structured hypertexts. Both groups received pre-tests at the same time and under the same conditions, where they were required to read hypertexts of a similar length that contained nine hyperlinks. This was followed by a task of completing nine comprehension questions. The reading comprehension strategy training started in the second week of the experiment. The two experimental groups were trained separately. They were taught cognitive, metacognitive and hypertext comprehension strategies explicitly, followed by exercises. Participants received a one-hour training session per week. Strategy instructions became shorter and briefer, and hypertext comprehension exercises became longer as the training progressed. After five weeks, both groups were given post-tests, which were set under the same conditions as pre-tests. Topics of hypertexts used in the two experimental groups in each session (including pre- and post-tests) were similar. In addition, participants in both groups were asked to complete a post-test questionnaire, in order to express their attitude to reading hypertexts and their ability to apply strategies.

The overall hypertext design followed a number of existing theories. Hypertexts were organised according to rationality principles proposed by Fastrez (2002). Jonassen’s (1986) principles of hypertext design procedures were used to connect the nodes of information. The overall screen display pattern followed Hemard’s (1997) suggestions. Furthermore, a readability test of hypertexts used in the present study was done, in order to make sure all hypertexts were adequate for participants’ levels of competency to comprehend written texts in English. The above theories and principles are discussed in detail in Chapter 5.
1.3 The structure of the thesis

This thesis consists of nine chapters. The overall structure of this thesis is as follows:

Chapter 1  Introduction
Chapter 2  Hypertext reading comprehension and e-learning
Chapter 3  Reading comprehension and metacognition in the hypertext context
Chapter 4  Reading and comprehending hypertexts by students from non-English speaking backgrounds
Chapter 5  The present study. Research Methodology
Chapter 6  Results
Chapter 7  Discussion
Chapter 8  A teaching methodology
Chapter 9  Conclusions. Limitations. Future avenues

The literature review section of the thesis contains three chapters, including Chapter 2, Chapter 3 and Chapter 4. Chapter 2 reviews and discusses two approaches for defining the term hypertext, known as the functional approach and the semantic approach. Special features of hypertexts, such as non-linearity and a new medium of reading, are summarised and analysed. The applications of blogs and wikis in the domain of education are discussed in Chapter 2 as well. Chapter 2 also reviews definitions of e-learning, the assessment of e-learning quality, students’ participation in e-learning, as well as their attitude towards e-learning.

Chapter 3 focuses on discussing reading comprehension, reading comprehension strategies and metacognition in the context of hypertext. It reviews definitions of reading comprehension presented in two theoretical
models, as well as their linkages to hypertext comprehension. Different types of reading comprehension strategies are summarised as well. In particular, metacognition and metacognitive strategies are discussed in the context of comprehending hypertexts. Chapter 3 also summarises different factors that influence students’ hypertext comprehension performance. In particular, the importance of teaching students to comprehend hypertexts metacognitively is an essential component of Chapter 3.

Chapter 4 is a review of hypertext comprehension performance by students from non-English speaking backgrounds (NESB). Definitions of NESB students are summarised. Factors that influence NESB students’ hypertext comprehension performance are analysed and discussed. Chapter 4 also reviews relevant literature on NESB students’ knowledge of metacognition while comprehending hypertexts.

Chapter 5 provides an overview of the present study and the research methodology. The aims and hypothesis of the current study are presented in this chapter. Underpinning theories of hypertext design, comprehension task design, reading comprehension strategy training design, as well as hypertext reading strategy training design are discussed in conjunction with their relevance to the present study. In addition, the overall research design, including participants, experimental instruments, as well as a detailed description of data collection procedures involved in the experiment are introduced in Chapter 5.

Chapter 6 concentrates on the presentation of the analysis of the data collected from the experiment. Statistical analysis conducted on data included an independent sample t-test and a paired sample t-test. Interpretation of data analysis is also included in Chapter 6.

Chapter 7 discusses linkages between results of the present study and relevant
prior studies. Firstly, there is a discussion of the influence of reading comprehension strategy training on NESB students' hypertext comprehension performance in conjunction with relevant prior studies. Secondly, connections between present results and previous research findings are discussed in terms of students' hypertext comprehension performance across different structures.

Chapter 8 recommends an effective teaching methodology, based on the experiment and research findings of the present study. This teaching methodology is presented in the hypertext reading comprehension context.

Chapter 9 concludes the present study and highlights limitations of the current study. Suggestions for future studies are made in this chapter.

The literature review of the thesis starts from Chapter 2. In this chapter, an extensive literature review is presented on applications of hypertexts in the domain of education, as well as e-learning, the quality of e-learning and students' attitude to e-learning.
Chapter 2

Hypertext reading comprehension and e-learning

The rapid evolution of ICT has enabled documents to be displayed on computer screens rather than on paper only. The term “hypertext” is used to describe computer-based texts with electronic links. Hypertexts have been increasingly involved in reading comprehension research studies in the last decades (Charney 1987; Salmeron, Canas, Kintsch & Fajardo 2005; Salmeron, Kintsch & Canas 2006b; Yankelovich, Meyrowitz & van Dam 1985). Although not originally invented and designed for instructional and educational purposes, hypertexts have drawn more and more attention from the education and training domain. It has been predicted hypertexts would become a dominating form of instructional materials (Bodomo, Lam & Lee 2003; Jonassen 1991; Kasper 2003). Therefore, the focus of this chapter is on analysing and discussing the application of hypertexts in the education sector in particular.

Hypertexts have a number of unique features in comparison with conventional print texts; for example, non-linear and multi-sequential texts, readers’/users’ control, and open texts (Landow 2006). Moreover, these unique features of hypertexts are believed to challenge the traditional way of reading, since the traditional way of reading is usually carried out in the conventional written text context (Landow 2006, 1989, 1994). In addition, as a result of the ICT evolution, hypermedia has been considered to be the expanded form of hypertexts and used widely in the education spectrum (Landow 2006).

The advent of ICT has enabled knowledge and information to be delivered in the form of hypertext and/or hypermedia on the Web. Web-based knowledge distribution is referred to as e-learning (Holmes & Gardner 2006; Rosenberg 2001). E-learning contributes flexibility and convenience to both e-learning
providers and learners, since it decreases constraints of time, distance and space (Rosenberg 2001). In fact, e-learning includes organisational elements, economic elements, technological elements, pedagogical elements and policy elements. In the recent literature on e-learning, these elements are considered to be critical issues that have impacts on the success of e-learning. Despite its flexibility and convenience, the quality of e-learning is questioned (Shank 2008). In response to these issues, researchers have proposed models to evaluate and determine factors that lead to the final success of e-learning. Additionally, students’ attitude to e-learning and their participation have also been examined and discussed, because students also determine the final success of e-learning. Therefore, e-learning and its relevant models are analysed and discussed in this chapter.

This chapter summarises and evaluates the definition of hypertexts, reveals special features of hypertexts and discusses the latest applications of ICT technologies for educational purposes. The chapter concentrates on analyzing the benefits of e-learning, as well as discussing factors that influence the quality and success of e-learning based on recent literature. In addition, students’ attitude to e-learning is discussed in this chapter.

2.1 Definitions of hypertexts

In this section, a brief historical review of the evolution of defining hypertexts is given, before various definitions are discussed. The idea of hypertext was inspired by an article about non-linear reading and thinking written by Bush (1945). The actual terminology was first introduced by Nelson (1965), who argues that hypertexts are written texts displayed on computer screens in a non-linear fashion. Nelson (1965) in fact has proposed two fundamental features of hypertexts: computers and non-linearity. Different hypertext systems, such as NoteCards and Intermedia (Conklin 1987), have been designed and used
alongside the swift evolution of computer-based technologies. Given that hypertexts are computer-based texts, the concepts of pages and binding do not apply to this context. In this regard, the notions of nodes and links have played roles as pages and binding. A node is an individual information piece presented in hypertext systems, while a link refers to an electronic routine that allows readers to travel from one node to another (Mazzali-Lurati 2007; Slatin 1990). Built on the foundation established by Bush (1945) and Nelson (1965), following researchers and scholars have defined hypertexts with different approaches. In 1995, Tolhurst reviewed previous studies on hypertexts and analysed two approaches for defining hypertexts: the functional approach and the semantic approach.

The functional approach describes the technological components and construction of hypertexts, including hypertext systems creation and interface design. This particular approach is often used by specialists in ICT, who define hypertexts from the technological perspective (Tolhurst 1995). A typical functional definition comes from Conklin's (1987) influential article, in which he emphasises that a hypertext is the extension of conventional print texts in a non-linear manner. In this case, “mechanisms are being devised which allow direct machine-supported references from one textual chunk to another; new interfaces provide the user with the ability to interact directly relationships between them” (Conklin 1987, p.17). This definition highlights a number of core technological elements of hypertexts, including computers, databases or networks (machine supported references), hypertext software (new interfaces), as well as nodes and links (inter-chunk relationships).

Later on, although hypertexts have been refined as the technology advanced, the above core elements of defining elements were still kept in relevant literature. For example, Leggett and his colleagues have developed a hypertext model from a purely technological viewpoint (Leggett, Schnase & Kacmar 1990). In this
model, they maintain that there are four key components of hypertexts, involving information elements, abstractions, anchors and links. Information elements are described as all information included in a hypertext such as texts, graphs and pictures. Abstractions are frameworks that enable information elements to be structured, grouped or related. Anchors are referred to as the sources or destinations of links. Links are recognised to be connectors among anchors. Compared to Conklin’s (1987) definition, Leggett et al.’s (1990) definition specifies the overall organisation and structure of hypertexts; however, it does not emphasise the role of computers as a platform to display information.

Sweeters (1994) defines a hypertext as a collection of information on a particular topic, activated by clicking on highlighted hot spots and then reading any additional information related to the given topic. In this definition, Sweeters (1994) remarks interrelationships and interactions among nodes and links in hypertext systems, even though he does not explicitly employ these two specific notions. Furthermore, the definition implicitly stresses the non-linear and multi-sequential nature of hypertexts. Non-linearity and multi-sequencing in reading are two issues that are often addressed by scholars who define hypertexts in the semantic way. Unlike previous functional definitions, Sweeters’s definition (1994) implicitly included some elements of semantic features when defining hypertexts.

The semantic approach concentrates on hypertext’s ability to connect information chunks by using links to establish interrelationships among nodes, based on readers’ cognitive reading processes (Tolhurst 1995). Therefore, researchers who employ the semantic approach usually define hypertexts from the reading comprehension standpoint.

Definitions by both Charney (1987) and Foss (1989) stress a hypertext is an electronically linked non-linear text piece that enables readers to determine their
individual reading sequences and text combinations. Thus, different readers are able to obtain different texts on the same topic based on different needs of information (Spiro & Jehng 1990). As a consequence, readers in fact have control over what they read and in what order they approach reading materials (Charney 1987; Tripp & Roby 1990). In this respect, readers become active in hypertext reading.

Snyder (1998) claims that hypertext is a computer mediated online information system. Under this system, blocks of information are structured and connected by electronic links and can be approached non-linearly. Furthermore, she remarks that hypertext is created by both authors and readers. Although authors organise all the contents presented in hypertext, readers are authorised to select their individual ways to read these materials. Snyder (1998) also argues that the introduction and explosion of the Internet has enlarged hypertext networks. Readers are allowed to read endless open texts as long as they follow online links.

Salmeron and his colleagues (Salmeron et al. 2005) define hypertext as “information systems in which the contents are organised in an interrelated network with nodes that are documents and links that are the relations between these documents”. This is another semantic definition of hypertext, since it concentrates on highlighting the interrelationship among nodes contributed by links. Thus, hypertexts are computer-based non-linear information networks that are empowered by the availability of electronic links. In general, semantic definitions focus on the non-linearity feature and the open text feature. In addition, readers’ choices and control over what they read are also emphasised by semantic definitions. On the other hand, these features are mentioned in functional definitions rarely.

In the 1980s, researchers have suggested that if multimedia information such as
video clips, audio clips, graphs, and animations, is integrated into hypertext nodes then hypertexts can be referred to as hypermedia (Conklin 1987). Gay, Trubull, and Mazur (1991) remark that hypermedia is an information organisation and presentation network that contains multimedia components, and allows users to construct information connections based on their individual interpretations of materials distributed by the system. Furthermore, Landow and Delany’s (1994) note reveals that hypermedia “extends hypertext by re-integrating our visual and auditory faculties into textual experience, linking graphic images, sound and video to verbal signs”. As hypermedia is increasingly investigated by researchers, there has been the tendency to use hypertext and hypermedia interchangeably, since the fundamental building blocks of these two terms are considered to be the same (Landow 2006; Oliver & Herrington 1995). However, not all researchers agree with this idea. For instance, Tolhurst (1995) argues that content in hypertext systems should remain static (e.g. printed words and pictures) as it would appear on any traditional print texts. If multimedia components such as video and audio clips, as well as animations, are used in computer-based network systems, these systems should be addressed as hypermedia only. In the current research project, hypertext will be used interchangeably with hypermedia, because the same technological foundations can be found in these two terms (Dillion & Jobst 2005).

2.2 Special features of hypertexts

In the hypertext reading context, the medium that stores and delivers information has radically changed over recent decades. Computers and relevant technologies have played the roles of information storage, display and distribution (Burbules & Callister 1996; Thurston 2004; Tindale 2005a). These radical changes have led to several unique characteristics of hypertexts:

- A new medium of reading;
- Non-linearity and multi-sequence in reading;
- The access to multimedia information;
- The “new roles” of readers in the hypertexts world;
- Interactions between readers and authors.

The above special features are elaborated and discussed in section 2.2.1 to section 2.2.5.

2.2.1 A new medium of reading

In the hypertext environment, readers read from computer screens instead of reading from flat print paper. Compared to conventional print texts, computers as a type of new medium present information on screens, store large volumes of information, and allow authors to update new contents. In the print-based texts context, information, including words and pictures, is presented on paper. However, hypertexts are displayed on computer screens. In this respect, readers do not physically turn pages but click on links and continue reading. Furthermore, given that hypertexts are electronically linked, the amount of information stored in hypertexts is much larger than traditional print-based texts. Additionally, hypertext authors are able to edit and update information online for the time being, by themselves. However, editing and updating print-based texts needs to be done by publishers, which costs money and requires substantial time. Thus, in this section, three key components of the new medium of reading will be discussed. They are:

- Screens;
- Large volume of information storage;
- Ease of editing and updating.
Screens

In the conventional reading context, fonts including sizes of characters, colours and spacing are pre-defined by publishers and the background colour has been predominantly in white. While in the hypertext world, authors are able to choose fonts and background colours of hypertexts based on their personal preferences (Dillion 1992; Tindale 2005). Black and white are no longer the dominating colours in the hypertext environment. Although authors have the freedom to determine fonts and background colours, some researchers still argue that the mismatch of background colours and character colours, and the use of irregular fonts, may lead to hypertext reading difficulties (Tindale 2005a). In the traditional reading context, readers cannot decide the sizes of their reading materials. However, when reading hypertexts, readers can choose the sizes of computer screens if they buy computers for themselves (Dillion 1992). Although, researchers have argued that if screen sizes influence hypertext reading (Dillion 1992; Oborne & Holton 1988), readers still enjoy the freedom to determine the screen size whenever it is possible. Altering the distance between readers and texts takes place in conventional text reading every day; however, this did not really occur when computer screens were fairly large in size. Nevertheless, as computers are produced smaller and smaller, readers can adjust the distance between themselves and computer screens quite conveniently (Dillion 1992; Landow 2006). In traditional reading circumstances, readers have to turn pages. While reading hypertexts, readers either scroll pages or press buttons to keep tracking the following information (Thurstun 2004; Tindale 2005a). In this respect, hypertext readers have a flexible way to continue reading.

Large volume of information storage

The swift development of ICT has ensured that computers are able to store a large quantity of information, which can be larger than any traditional paper medium can store. Apart from written text, hypertext systems can also keep
multimedia materials such as video and audio clips (Slatin 1990; Yankelovich et al. 1985). The information storage of hypertexts has been enlarged by the introduction of the Internet, given its online information connection (Coiro 2003; Sutherland-Smith 2002a). Readers have access to dictionaries, encyclopaedias, as well as other information online, without physically looking for them on library book shelves (Burbules & Callister 1996).

Ease of editing and updating
In the traditional sense, it would be difficult and expensive for authors to adjust and/or delete information when books or other texts have been published. In the hypertext world, authors can add, delete and/or adjust information they have put on hypertext systems whenever they need to. (Yankelovich et al. 1985).

2.2.2 Non-linearity of hypertext reading
In conventional print texts, orders of paragraphs and pages have been pre-defined by authors. Readers can only follow paths set by authors. This situation is different in the hypertext world. Readers are allowed to create their own hypertexts and reading sequences by clicking on different links presented in different nodes. Furthermore, different organisations and combinations of links present different types of hypertext structure. Thus, it is believed that non-linearity of hypertexts relies on the dynamic of hypertext structures (Landow 2006). Two key elements that determine the non-linearity of hypertexts are:

- Electronic links;
- Hypertext structures.

Electronic links
Clicking on different links leads to various information retrieval sequences, since links carry the reader from one node to another electronically (Mazzali-Lurati 2007; Morgan 2002). In this sense, readers are able to formulate their own
hypertexts based on their personal interests and/or individual interpretations of given topics (Salmeron et al. 2005). Normally links are shown on computer screens bolded and underlined, and embedded in hypertexts. Researchers have suggested that the wording of links plays an important role in hypertext design, because links attract readers’ attention and inform them of what they will read in a new node (Wei, Evans, Eliot, Barrick, Maust & Spyridakis 2005).

Hypertext structure

Hypertext structures are frameworks in which links are organised and presented to connect nodes in different approaches (Oliver & Herrington 1995). Figure 2.1 presents three types of hypertext structures, including a linear structure, a hierarchical structure and a referential structure. Linearly structured hypertexts are widely used for educational and instructional purposes and resemble conventional print texts. Readers are allowed to click on links included in a node, read information presented in new nodes or pop-up windows, and then go back to reading the main text again. In other words, there are no new links included in new nodes or pop-up windows in linearly structured hypertexts; readers only get links in main texts. While interacting with hierarchically structured hypertexts, readers can click on any link and then travel further and further by selecting links presented in following nodes. A classical example of the hierarchically structured hypertexts is Wikipedia, in which readers are able to go further and further, as long as they choose to click any links involved in a new web page. Hypertexts with a referential structure are hardly structured, since readers have complete freedom to establish connections between any nodes by choosing any links. Searching and surfing web pages on the Internet is a typical example that illustrates how referentially structured hypertexts work (Oliver & Herrington 1995). Moreover, with the availability of the Internet, hypertexts serve as open texts for readers, since readers are able to obtain endless texts by clicking on various links (Landow 2006).
Non-linearity hypertext reading is an attribute of the hierarchical structure and referential structure. Non-linear reading refers to how the sequence of words, sentences and paragraphs alter, due to being read by different people (Aarseth 1994). Therefore, no text sequences have been pre-determined by authors (excluding linearly structured hypertexts) in an open and dynamic hypertext world. The dynamics of hypertext links have allowed readers to read hypertexts in a flexible fashion, by selecting different links in diversified orders and therefore formulating different hypertext combinations (Landow 2006; Slatin 1990). In this respect, readers find out individual pathways through the hypertext world to build their comprehension of what they have been reading, which is referred to as navigation (Madrid, Van Oostendorp & Melguizo 2009). The freedom of navigation has delegated control over texts to readers, which encourages them to reflect on what they have learnt about certain topics and establish their own linkages between their prior knowledge and hypertexts (Scheiter & Gerjets 2007). In addition, Landow (2006) comments that, given navigation leads to diversified reading orders and text combinations, non-linear hypertext reading can also be defined as multi-linear and multi-sequential reading. However, hypertext
navigation also results in potential reading difficulties for readers, because they may get lost in the hypertext environment. This phenomenon is also known as disorientation (Conklin 1987; Oliver & Herrington 1995), which will be further discussed in later sections of this chapter.

2.2.3 Access to multimedia information

Information, including verbal texts, pictures, tables and diagrams, displayed in traditional print-based medium is static and flat. By contrast, hypermedia has enabled readers to acquire motion and multi-dimensional multimedia contents such as animation, audio and video clips, and graphics (Scheiter & Gerjets 2007). In this sense, readers not only read but also listen to and/or watch hypermedia. Thus, hypermedia reading materials become more active than what has been presented in any paper-based medium, which is arguably an advantage that assists readers in comprehending materials (Landow & Delany 1994). In addition, multimedia information in the hypermedia world can also be accessed and read in a non-linear fashion. Readers can navigate their own pathways through hypermedia systems and formulate individual combinations of contents. Nevertheless, researchers also argue that the inclusion of multimedia content can lead to difficulties in comprehending materials, including cognitive overload and disorientation (Conklin 1987; Scheiter & Gerjets 2007). However, the influence of multimedia contents on comprehending hypertexts is not the focus of the present study. This issue can be further discussed in future research.

2.2.4 “New roles” of readers in the hypertext world

Traditionally, readers play relatively passive roles when reading conventional print texts, given sequences of contents and page numbers have been pre-defined by authors. When reading hypertexts, readers tend to be more active than when they read traditional paper-based texts. Slatin (1990) defined three types of hypertext readers based on purposes of reading:
• Browsers
• Users
• Co-authors

Browsers
Browsers are those who read for pleasure in the hypertext environment without specific expectations or purposes. They travel aimlessly, but not carelessly, in the hypertext world, clicking on links that interest them and keeping on travelling when they finish reading the node. In this case browsers are not necessarily reading all the information involved within a hypertext system or a website. They only spend time on the information they are most interested in. Furthermore, as more and more multimedia contents such as audio clips, animations, and video clips, are included in hypertexts, some readers are willing to spend time on interacting with these special features (Lawless, Mills & Brown 2003). These readers also browse hypermedia without particular aims, other than experiencing digitized-media contents. Lawless et al. (2003) refer them as feature explorers.

Users
Users are readers with clear purposes for reading, who usually start searching specific information and finish reading as soon as they complete what they had planned to read. Users are also categorised as knowledge seekers by Lawless et al. (2003), who also note that these readers are more strategic in locating, acquiring and comprehending information.

Co-authors
Co-authors are readers who interact with hypertexts deliberately. Co-authorship is the distinctive difference between conventional paper-text readers and hypertext readers. Hypertext readers are able to make comments, add links to
existing contents and modify current materials. The use of blogs and wikis are typical examples of co-authorship amongst authors and readers.

2.2.5 Interactions between readers and authors
Non-linear hypertext reading has enabled readers to retrieve information in a more active manner in comparison with the conventional print-text reading. Apart from being given control over what they have been reading in terms of reading sequences and choices, readers are also encouraged to express their opinions and comments on certain topics in a full hypertext system (Landow 2006). However, hypertext systems developed in early stages, such as the World Wide Web (WWW), were unable to provide readers with the freedom to comment on hypertext contents, due to technological limitations. Web 2.0, known as a collection of ICT that empowers users to create various online communities and networks for information sharing and socialising purposes (Constantinides & Fountain 2008), has been gradually employed by the education domain (Collis & Moonen 2008; Tu, Blocher & Roberts 2008). Major components of Web 2.0 technologies include blogs, social networks (such as Myspace and the Facebook), and wikis (for example Wikipedia) (Constantinides & Fountain 2008). Increasingly, research literature has focused on the usage of blogs and wikis for educational and instructional purposes (Farmer, Yue & Brooks 2007; Koskimaa 2007; Robertson 2008). The application of blogs and wikis in the education context will be elaborated next.

2.3 Application of blogs and wikis
As discussed in the earlier section, Web 2.0 technologies have been increasingly employed by the education spectrum. Special features of Web 2.0 technologies, such as information sharing and discovery, have allowed them to be utilised by students and teachers. Thus, some authors and researchers investigate educational affordance. Educational affordance describes the degree
of interaction between an educational intervention and characteristics of learners that enable learning to take place (McLoughlin & Lee 2007). In the context of Web 2.0, educational affordance refers to the availability and accessibility of Web 2.0 technologies that enable learners to undertake learning. McLoughlin and Lee (2007) argue that Web 2.0 technologies bring the idea of open communities into the domain of education and allow students to co-create contents with instructors.

There are a number of benefits of applying Web 2.0 technologies in educational settings. First, they strengthen connectivity amongst students and teachers. Students are encouraged to express their ideas and opinions, exchange their evaluation of learning materials and develop their own digital literacy. In response, teachers are able to know students’ attitude to learning materials and various subjects (McLoughlin & Lee 2007). Secondly, students are able to work collaboratively online due to the availability of Web 2.0 technologies. For instance, students can be asked to co-write a report on certain topics, based on their research and knowledge in the context of wiki (Trentin 2009). Thirdly, Web 2.0 technologies allow all users to add tags to contents (e.g. blogs), which makes online searching convenient. In this sense, both students and teachers are able to locate the information they want online in a swift manner (Collis & Moonen 2008). Lastly, Web 2.0 technologies have been widely used worldwide due to its low-cost and user-friendly nature. Therefore, educational institutions and students can afford to integrate these technologies into their learning processes (Hourigan & Murray 2010). In fact, besides wikis and blogs, synchronous (e.g. Windows Live Messenger and Google Chat) and asynchronous communication facilities (e.g. emails and discussion board), as well as learning management systems (e.g. Blackboard), are also broadly used for educational purposes (McLoughlin & Lee 2007). However, the focus of Web 2.0 technology applications in this chapter is on blogs and wikis.
2.3.1 Blogs and their application in the education sector

Blogs are "online journals where an author (or authors) publishes a series of chronological, updateable entries or posts on various topics, typically of personal interests to the author(s) and often expressed in a strongly subjective voice, on which readers are invited to comment" (Farmer et al. 2007, p. 262). Blogs have not only included distinctive features of early hypertext systems, such as links and multimedia contents, but have also provided opportunities for readers to comment on posts (Williams & Jacobs 2004). In the blogging atmosphere, readers are authorised to contribute comments and arguments on what they have been reading; meanwhile, blog authors are able to have conversations with readers by replying to their comments and arguments online. This form of interactive online communication on one topic can be continued as long as authors and readers wish. Moreover, authors can edit and update their posts as online discussions with readers progress. As an open source, blog technology is available to teachers and students at no cost, and is user friendly (Strampel & Oliver 2008).

Farmer, Yue and Brooks (2007) identify four pedagogical benefits for students if blogs are used for educational purposes. First, they help students become subject-matter experts via regular posting, updating and replying to comments. Secondly, they distribute ownership of learning to students, possibly increasing students' interests in learning. Thirdly, students are able to obtain a sense of a learning community while learning with blogs. Lastly, blogs allow diverse perspectives on the same topic, which in turn allows students exchange opinions.

It is argued that using blogs can facilitate students' reflection in learning. Reflection refers to goal-oriented thinking processes on what has been learnt (Moon 1999). Students deepen their understanding of new knowledge as their reflection moves to higher levels. Reflection allows students to critically review
what they have learnt and integrate new information into what they have known (Moon 1999). There exist different levels of reflection. The higher the level of reflection, the deeper learners learn. When writing blog posts for educational purposes, students are normally asked to review what they have learnt and comment on others’ posts. In this process, students can gather perspectives from peers and integrate them into their own knowledge bases (Xie, Ke & Sharma 2008). This is in line with Moon’s (1999) argument that working with peers can facilitate reflection in learning.

Strampel and Oliver (2008) conducted a research study to explore the relationship between using blogs and students’ reflection in learning. They integrated blogs into an online accounting subject and asked students to write blog posts on a weekly basis throughout a semester. Data was collected from students’ weekly posts, the convener’s comments, a pre-activity questionnaire and a post-questionnaire from both the convener and students. In the student version of post-activity questionnaire, students were asked to recall their levels of reflection based on Likert questions. The result revealed that high levels of reflection had been achieved by students. However, researchers also admitted that other instruments and technologies were included in the research, including Elluminate chats, the Wiki, group presentations and the convener’s facilitation and support. They argue the combination of the above instruments and technologies promotes a high level of reflection in learning (Strampel & Oliver 2008).

Xie, Ke and Sharma (Xie et al. 2008) carried out a study to investigate the influence of writing blogs on reflection in learning. Participants were required to write blog journals on one subject on a regular basis throughout a semester. No other associated facilities or technologies were mentioned. The results revealed that as long as students kept writing blogs, their levels of reflection in learning could grow higher. Moreover, researchers included peer feedback as a variable
for data analysis. It was found that peer feedback on blogs did not promote higher levels of reflection. It might be that the quality of peer feedback may not be constructive or informative. Students may only write “good job” or “I agree” in their feedback. This conclusion implies that guidance and feedback from teachers and instructors seem to be essential (Xie et al. 2008).

According to a study conducted by Ellison and Wu (2008), students’ attitude to the use of blogs varies. On the one hand, some university students enjoy the use of blogs for educational purposes, since they are able to read others’ ideas and acquire feedback in an informal manner. On the other hand, other students found it stressful to use blogs, since they have to remember their passwords, put critiques on others’ ideas and tend to be aggressive to others. In the education sector, researchers found that blogs are a valuable addition to current educational technology, since they promote greater interactions with peers and instructors (Williams & Jacobs 2004); nevertheless, blogs, if used as an instructional instrument on their own, do not really enhance high levels of reflection on knowledge, since they do not improve student collaboration or require students to use outside resources as references to complete tasks (Strampel & Oliver 2008).

2.3.2 Wikis and their application in the education sector

The term wiki-wiki is a Hawaiian phrase referring to “quick” (Lin & Kelsey 2009). Wikis refer to user-centred online encyclopedias developed and edited by individual users (readers), in which each user is encouraged to contribute their knowledge on any topic (Gullett & Bedi 2007). Wikipedia is a typical application of wiki technology in contemporary society.

Three benefits of applying wikis in education are widely recognised. First, wikis are user friendly. It is possible to operate wiki systems with any type of web browser. Users do not have to be experts in ICT to use wiki technologies. Thus,
simplicity is considered to be one key feature of wikis. (Zorko 2009). Secondly, flexibility is a key feature of wiki systems. Wikis allow online contents to be created, modified, edited and/or deleted by any user anywhere, at any time. Boundaries of distance have been blurred by wikis when users create and edit contents online collaboratively (Thomas, King & Minocha 2009). Wikis in fact make every user an author, which fosters online interaction and information exchange. Additionally, wikis enable all contributors to incorporate text, audio, pictures, video and hyperlinks to other web pages (Robertson 2008). Lastly, costs related to purchasing, maintaining and supporting wiki systems are relatively low, due to the wide spread availability of Web 2.0 technologies. Moreover, given the flexibility and the convenience of wikis, teachers’ time for instruction and marking is reduced, which also decreases the instructional costs of teachers’ salaries (Zorko 2009).

In fact, there are a number of risks in implementing wikis in education (Ebner, Kickmeier-Rust & Holzinger 2008). First, the accuracy of information is questionable. Some contributors may not be experts in certain areas and thus, can provide some incorrect information. Secondly, contributors may only select information based on their own interests and knowledge bases. In this sense, information presented in wikis may not cover every aspect of a topic. Lastly, it can be difficult to back track references. If sources of information are non-digitised (i.e. in a print format), readers may not get access via the Internet. Moreover, it is not compulsory in wiki systems to provide references, which makes backtracking references even harder for readers (Ebner et al. 2008).

Elgot (2007) conducted a program that requested two groups of students complete their group projects by using wikis. Wikis were incorporated into two master subjects. In each subject, students were asked to complete written group assignments by using wiki technology. Data was collected throughout a semester. The conclusion of this study remarks that students are able to use wiki
technology to accomplish group academic tasks collaboratively and successfully. Moreover, Elgot and research colleagues concluded that student participants believed that wiki had encouraged them to take part in group assignments, as well as made information collection easy for group tasks. In addition, teacher participants maintained that wiki had made marking group assignments easier for them (Elgort, Smith & Toland 2008). Teachers’ perceptions in this research are consistent with the benefits of wiki suggested by Zorko (2009).

Furthermore, Ruth and Houghton (2009) carried out a research project to explore students’ perceptions of applying wikis in their learning activities. In this research wikis were embedded in an e-learning based subject. All students were instructed on how to use wikis before the research started. Data was collected from wiki contents and activities undertaken by students, as well as students’ reflections and opinions on the subject. Students recognised that wikis had enhanced their ability to collaborate and cooperate with others. Moreover, the conclusion of this project states that employing wikis for educational purposes also calls for deep levels of reflection in learning, since students’ roles are shifted from passive readers to active authors (Ruth & Houghton 2009).

In summary, Web 2.0 technologies enhance interactions among authors and readers and blur traditional boundaries of readers and authors. Blogs and wikis are typical examples of Web 2.0 that illustrate the interaction among authors and readers in hypertext reading. Hypertext authors are able to exchange ideas, and possibly obtain new information, via reading and replying to comments and arguments posted by readers. Thus, as Landow (2006) suggests, hypertext writing is accomplished collaboratively by both authors and readers.

2.4 E-learning

As computers and the Internet have been increasingly utilised for educational
purposes, e-learning has played an important role in conveying and delivering knowledge to students on a broad scale (Nicholson 2006; Rosenberg 2001). E-learning has been developed based on the latest technology at the time. Comprehending hypertexts is considered to be the core of e-learning (Dunser & Jirasko 2005). In this section, the definition and benefits of e-learning will be presented. In addition, e-learning related theoretical models that evaluate factors affecting the quality and the success of e-learning will be summarised. Furthermore, students’ attitudes and perceptions of e-learning will be discussed.

2.4.1 Definitions of e-learning

E-learning has been defined by different researchers and scholars. Rosenberg (2001) defines e-learning as “the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance”. This definition covers a number of attributes of e-learning and emphasises the importance of technology in e-learning. According to Rosenberg (2001), there are three key criteria when defining e-learning, including:

- Network for information and knowledge updating, storage and distribution;
- Computers with standard Internet applications for users to retrieve online information;
- Provision of learning that blurs the limitation of time, distance and space (Rosenberg 2001).

Rosenberg (2001) argues that Internet technology serves as a distinctive feature of e-learning. Although information and knowledge stored in CDs or DVDs are also included in technology-based digital instruction approaches, instructors are not able to upload the latest update promptly. Furthermore, learners are not able to receive the latest update either. Thus, Internet-supported knowledge distribution and sharing differentiate e-learning from other forms of
technology-based learning (Rosenberg 2001).

Given e-learning courses are conveyed via the Internet, e-learning students receive online instructional materials from their computer screens. In this respect, computers for e-learning purposes should be equipped with standard Internet technology and applications, such as web browsers and media players. Some argue that computer-based learning can be used interchangeably with e-learning. However, students in the computer-based learning context do not necessarily have their computers connected to the Internet. They could approach learning materials via CDs/DVDs or learning programs installed in their computers (Rosenberg 2001).

Considering the flexibility and convenience of communicating online, e-learning blurs the limitation of time, distance and space. In other words, e-learning reaches its students universally. As long as students have access to computers and the Web, they are able to undertake e-learning courses. Thus, e-learning reaches a broad body of students (Rosenberg 2001).

Holmes and Gardner (2006) define e-learning as “online access to learning resources, anywhere and anytime”. This definition stresses the convenience of e-learning as well as its flexibility. This short definition parallels Rosenberg’s (2001) argument on e-learning’s universality. Although it does not explicitly highlight the importance of technologies and facilities, it implies that technologies and e-learning facilities bring convenience and flexibility into e-learning communities (Holmes & Gardner 2006).

E-learning is described as Web-based flexible knowledge delivery that caters to a broad variety needs and expectations of learners (Nicholson 2006). Similar to Rosenberg’s (2001) definition, it highlights the essential role of the Internet in knowledge dissemination. Furthermore, both Rosenberg’s (2001) and
Nicholson’s (2006) definitions emphasise that e-learning meets learners’ diversified needs and expectations.

Kilic-Cakmak (2010) defines e-learning as a learning environment that includes synchronised and/or asynchronised online teaching activities, ICT-based knowledge presentation and distribution, as well as students’ learning activities. Moreover, Kilic-Cakmak (2010) also suggests that e-learning provides appealing education alternatives and accommodates learners’ needs for lifelong learning. This definition covers three aspects of e-learning, involving teachers, technologies and students. In comparison with previous definitions (i.e. Rosenberg’s, Holmes and Gardner’s and Nicholson’s), this definition highlights teachers’ activities particularly. Additionally, it implies online interactions between teachers and students. On the other hand, it also stresses the importance of technologies in e-learning.

In general, e-learning employs the latest technologies to assist and enhance its knowledge distribution, and calls for flexible and active interactions amongst online teachers and students. Furthermore, it also offers convenience to both teachers and students in terms of information updating, delivering and receiving. In this regard, it is necessary to discuss benefits of e-learning.

2.4.2 Benefits of e-learning

Holmes and Gardner (2006) suggest four major benefits brought up by e-learning:

- It covers learners from different groups with various backgrounds and expectations;
- It ensures the latest update of knowledge and information in order to cater to the needs of various groups;
- It creates a learner-centred atmosphere;
• It enhances the quality of education.

First, e-learning serves needs of learners from all categories including students, trainees and lifelong learners. Learners with disabilities and other special needs are also included in the e-learning community. Although they engage in e-learning with various demands and expectations, they are able to find materials and information that fit their individual circumstances. Thus, it is believed that e-learning excludes nobody regardless their geographic, physical or social circumstances (Holmes & Gardner 2006).

Secondly, e-learning allows prompt updates of knowledge and materials presented online, so as to accommodate the demands and expectations of e-learners from diversified backgrounds. Learners from different groups request different information and knowledge for individual educational or training purposes. In this regard, e-learning offers rapid, accurate and convenient access to specific knowledge demanded by various e-learners (Holmes & Gardner 2006).

Thirdly, e-learning allows a learner-centred approach to be utilised. Learners are allowed and encouraged to select time, place, and contents to suit themselves in the e-learning context, regardless of geographic, physical and social limitations. Furthermore, learners are able to build various learning communities, based on subjects and topics they are particularly interested in, with experts and other peer students. In this case, e-learners can exchange individual opinions and evaluate what they have obtained through online communications (Holmes & Gardner 2006).

Finally, e-learning enhances the quality of education, given the fact that learners are provided with a flexible, fast, and convenient learner-centred approach to acquire knowledge. Holmes and Gardner (2006) maintain that e-learning
enriches and extends students learning experience, due to the use of hypertexts and hypermedia materials. Furthermore, as Web 2.0 technologies, such as blogs and wikis, are implemented in the domain of education, they also enhance communication and interaction between e-learning peers, as well as e-learners and instructors (Farmer et al. 2007; Gullett & Bedi 2007).

Apart from the above advantages generated from the educational perspective, Rosenberg (2001) also suggests several benefits of e-learning from the economic perspective. For instance, e-learning providers do not have to organise and offer classroom facilities to e-learners, since they can obtain access to learning materials via computers. Furthermore, e-learning enables educational institutions to recruit as many e-learners as they want, given the universality and flexibility of e-learning, and regardless of physical space limitations of e-learning vendors.

2.4.3 Factors that affect the success of e-learning
Criticism of e-learning has gradually grown with the increased use of ICT in the education sector. The core of criticism questions the quality and the success of e-learning courses (Shank 2008). Thus, researchers have started to explore factors that may have impacts on the success of e-learning and its quality.

In fact, evaluating quality of education has a long history. In 1966, Stufflebeam introduced the CIPP model for institutions to evaluate their educational programs (Marques, Noivo & Verissimo 2007). CIPP is an acronym for context evaluation, input evaluation, process evaluation, and product evaluation. This model assesses current situations of programs being appraised, as well as input-output transformation processes. It seeks strengths, weaknesses, opportunities, and threats of target programs, and provides direction for improvement for the future. As e-learning has developed as a new paradigm in the education sector, research literature focuses on e-learning programs appraisal. In 2000, Volery
and Lord conducted a study, which concludes that technology, and the characteristics of instructors and students influence the effectiveness of online education (Volery & Lord 2000). McPherson and Nunes (2003, cited in McPherson & Nunes 2006) established a model called “Critical Success Factors” to evaluate factors that determine the final success of e-learning in a systematic approach.

2.4.3.1 Critical Success Factors of E-learning

McPherson and Nunes (2003, cited in McPherson & Nunes 2006) introduced a model called “Critical Success Factors” (CSFs) in order to specify factors that contribute to the final success of e-learning. They employed a focus group interview approach, which involved academics and researchers during a number of e-learning focused conferences in 2002, in order to establish the framework. There are five broad categories of e-learning factors are included in this model. They are:

- Organisational issues;
- Technological issues;
- Curriculum design and development issues;
- Institutional system design issues;
- Delivery issues.

McPherson and Nunes (2006b) argue that the five CSF categories do not have explicit boundaries, since they influence and interact with each other in the process of e-learning organising, design and delivery.
Figure 2.2 Critical Success Factors (CSFs) Framework
CMC = computer mediated communication; VLE = virtual learning environment

Figure 2.1 shows the interaction amongst the five categories of CSFs. The vertical axis represents organisational factors included in e-learning, while the horizontal axis represents the extent to which academic staff get involved. The organisational setting requires the highest administrative input but the lowest academic involvement. The involvement of administration decreases as more technological knowledge and practical knowledge are needed in e-learning. Delivery issues contain the highest level of academic contribution but the lowest level of administration amongst all five categories. The five categories of CSFs are discussed below.

Organisational issues
These refer to stakeholders organising and implementing e-learning in academic institutions. McPherson and Nunes (McPherson & Nunes 2006) stress that the main stakeholders in e-learning are educational practitioners, researchers, administrators and technologies. They therefore argue that organisational leadership plays the role of balancing needs and expectations of all stakeholders, and managing change and development while conducting e-learning. In terms of organisational issues, the role of management and administration becomes
crucial in every aspect of e-learning. First e-learning managers ought to consider leadership, and structural and cultural issues, when planning and conducting e-learning programs. They need to take into account organisational structures and culture if they want to adopt their traditional academic settings, pedagogies and facilities into the ones that cater to the conveyance of e-learning. Moreover, considering the fact that academic staffs’ attitude to introducing e-learning varies, it is believed that good communication is the key element of leadership to smooth e-learning implementation, and balance diversified opinions. Secondly, the design of e-learning courses requires support and facilitation from managers and administrators, since it calls for collaboration between specialists in education and ICT, as well as subject matter experts. Thirdly, the rapid evolution of ICT has posed challenges to e-learning providers in the use of resources, technologies and other relevant facilities. It is expected that managers seek the balance between the use of technology and the content of e-learning programs. Lastly, the management of e-learning providers needs to organise an appropriate approach to deliver e-learning programs designed in accordance with the current facilities, pedagogical approaches, organisational behaviour and staff attitude. Thus, in the context of e-learning management, it has become significant to determine who the decision-makers are and how to facilitate the implementation of e-learning. Wagner, Hassanein and Head (2008) also maintain a similar viewpoint on the importance of organisational issues in implementing e-learning successfully. Moreover, they remark that e-learning is related to marketing educational products. Thus, coordination and cooperation across relevant departments become vital to present and deliver products appropriately.

Technological issues
These refer to the combination of underlying infrastructure and e-learning software that enables e-learning to be carried out (McPherson & Nunes 2006). There are three major components involved in e-learning technology: individual
work stations for learners and teachers, appropriately designed and connected ICT networks, and software tools that enable experts in education to convey their subjects. According to McPherson and Nunes (2006), significant attention should be paid to technological issues since technologies underpin the establishment and the implementation of e-learning. They claim that three major CSFs are included in technological issues: organisational issues, design issues, and delivery issues. In terms of organisational issues, they argue that management policy influences the use and update of e-learning technologies, as well as the funding, purchase and maintenance of technologies. From the curriculum design and delivery perspective, technologies provide platforms for curricula to be organised and conveyed online. Moreover, it is expected that technologies used for e-learning are effective, efficient and reliable to ensure the overall quality of e-learning. McLoughlin and Lee (2008) state that as Web 2.0 technologies become popular and affordable, applying these technologies as e-learning infrastructure would increase collaboration amongst learners and teachers. Researchers argue that conventional e-learning systems and pedagogical approaches are still teacher-centred (Nazemi, Cukusic & Cranic 2009). In contrast, Web 2.0 technologies allow student-centred approaches to be implemented. Students are provided opportunities to communicate actively and work collaboratively with their peers online, while teachers tend to play the role of facilitators.

Curriculum design and development issues
These are linked to the selection of pedagogy, the organisation and presentation of contents, the process of curriculum design, and the selection of human resources (McPherson & Nunes 2007a). Curriculum design requires well organised pedagogical design; therefore, the selection of pedagogical models is recognised to be one of the building blocks of curriculum design. When considering e-learning content, selection of sources, information structure and update, the use of hypermedia, and activity design formulate the core of the
e-learning content. The actual curriculum design process consists of teamwork among academics, technologists, subject matter experts, student representatives and even alumni. In order to build a design team appropriately, it is necessary to select people with the right skills. Therefore, McPherson and Nunes (2007a) emphasise that curriculum design and development calls for “a team effort aiming at developing not only efficient content structuring, but also the development of new pedagogical models and corresponding learning and teaching approaches”. In the era of Web 2.0, e-learning pedagogy has also been updated to Pedagogy 2.0 (McLoughlin & Lee 2008). Curriculum design should be flexible and open for negotiation in the Pedagogy 2.0 context and enable students to contribute their input into curricula.

Instructional system design (ISD) issues
These are defined as the framework that comprises technological, pedagogical and organisational components needed to establish viable learning environment and programs (McPherson & Nunes 2007b). In the e-learning context, a learning environment refers to “an application specially produced for a particular learning purpose or learning need, built using a particular pedagogical philosophy and a specific delivery technological platform” (McPherson & Nunes 2007b, p.232). Thus, the ISD in the e-learning environment has to ensure interaction among teachers and students, and the structure and interrelationship of materials. Thus, the importance of team collaboration among specialists in education, technology and subject experts becomes apparent when creating an effective e-learning environment. Furthermore, consistency of pedagogical approach becomes critical in ISD; otherwise, conflicts and delivery difficulties can be created. However, factors including usability, accessibility, quality of subject materials, and the use of multimedia are also considered to be vital in e-learning ISD. Both Web 2.0 technologies and the Pedagogy 2.0 notion criticise the traditional ISD, which is based on the closed classroom approach where students do not have much control. Pedagogy 2.0 proposes a personalised approach to ISD called
Personal Learning Environments (PLE’s). PLE’s is learner-centred. It brings greater control to students than they have in an instructor-centred and controlled online learning system (McLoughlin & Lee 2008).

Delivery issues
These require new approaches to teaching and learning skills (McPherson & Nunes 2008). Four main CSFs have been identified: teachers’ and learners’ attributes, delivery models, training for teachers and learners, as well as leadership. First, teachers’ and learners’ attributes refer to their experience and motivations when interacting in an e-learning environment. Furthermore, e-learning courses require sufficient preparation from both teachers and students, in order to maximise the outcome. Secondly, McPherson and Nunes (2008) highlight that a sound pedagogical model is needed to determine appropriate and consistent e-learning delivery models. Thirdly, support and training play significant roles in e-learning delivery, since both teachers and students need to get familiar with new technologies and systems via constant training programs. Finally, leadership needs to balance the needs and expectations from different stakeholders, and offer guidelines to institutions through necessary change and development. Additionally, Figure 2.1 indicates that researchers play an important role in delivering e-learning courses as well. Researchers are able to test the feasibility of pedagogical models, analyse the latest trend of e-learning, as well as link the latest technologies into e-learning communities. Moreover, McLoughlin and Lee (2008) remark that student-generated content, such as blog diaries and chat logs, is also an important issue in e-learning delivery in the era of Pedagogy 2.0. Pedagogy 2.0 empowers students to review and evaluate what they have learnt and read throughout their online learning processes. Students can create their content either individually or collaboratively by using Web 2.0 technologies. It is believed that student-generated content increases students’ online learning productivity.
Overall, the CSFs model is a framework that examines factors that determine the success of e-learning from organisational, technological and practical perspectives. Furthermore, interviews with the focus group indicate that factors mentioned in the model are interrelated and influence each other. It is also believed that e-learning demands collaborative teamwork among educational experts, subject matter experts and technologists.

2.4.4 Assessing the quality of e-learning
Examining and evaluating the quality of e-learning turns critical because quality represents the reputation of e-learning vendors. Moreover, e-learning quality also has an impact on the final success of e-learning. Marques, Noivo, and Verissimo (Marques et al. 2007) proposed an e-learning evaluation model called e-QUAL, which appraises e-learning quality from four perspectives: learning contents, learning management system (LMS), process, and results. The first two areas deal with the significant resources for e-learning subjects; the third area concerns necessary human resources and the whole process created by them; the last area is related to consumers’ satisfaction level, which is considered to be core in the e-learning quality assessment.

In order to assess learning contents, written content, multimedia content, complementary bibliographical sources and the content management system need to be taken into account. Written and multimedia content provide necessary materials and information to learners via the content management system. Moreover, if learners want to access some in-depth information, they can refer to complementary bibliographical sources to obtain what they want (Marques et al. 2007).

LMS requires people to evaluate e-learning from the infrastructure perspective, including the common space of the learning community, asynchronous communication and synchronous communication. The above three items assist
learners in building e-learning communities online, since they are able to exchange and share their individual opinions, ask questions of teachers and peer students, and enlarge their knowledge by communicating with peer students universally (Marques et al. 2007).

E-learning process evaluation consists of administrative management, technical management, management of contents transfer, management of learning communities, and learners’ evaluation. Administrative management refers to administrative staff, including staff responsible for marketing, enrolment procedures, as well as payment. Technical management involves technology that supports the content management system and LMS. Management of contents transfer, and management of learning communities, are related to the availability of teaching staff, learning content, as well as the support and facilitation offered by teaching staff. Learners’ evaluation is related to subject assessment, and in this case teaching staff are able to investigate learners’ performance (Marques et al. 2007).

In terms of results, it is important to appraise the knowledge and skills acquired, training recognition, learners’ satisfaction and business. Knowledge and skills are regarded as items that can identify e-learning quality in a distinctive way, as they indicate what learners have or have not mastered after a period time of learning. Training recognition remarks the importance of acquiring accreditation from professional organisations and academic institutions. Learners’ satisfaction is the most sensitive issue in e-learning, since true satisfaction will not be achieved unless it is perceived by clients. Finally, e-learning as a business should be run in a sustainable fashion, since e-learning requires investment and it is vital to pay attention to the return of investment (ROI). If not, an e-learning business may fail. Moreover, authors admit that quality can be assessed from different perspectives; thus, quality assessment should be open to various values, interests and objectives (Marques et al. 2007). However, in comparison
to assessing other e-learning result issues, learners’ satisfaction is critical, since it can be subjective and hard to measure by quantitative data. In this respect, authors should establish certain benchmarks to make learners’ satisfaction measurable and quantifiable.

To sum up, the e-QUAL model analyses four areas that determine the quality of e-learning. They are:

- Learning content, including written and multimedia contents, as well as bibliographical sources, under a content management system;
- Learning management system, involving learning communities, asynchronous and synchronous communication;
- Process, consisting of administrative management, management of technology, contents and learning communities, as well as learners’ evaluation;
- Results, comprising knowledge acquired, training recognition, learners’ satisfaction, and the ROI.

2.4.5 Students’ participation and their perceptions of e-learning

The above two models assess e-learning from an e-learning vendor perspective. Nevertheless, the above summaries indicate neither the CSFs nor the e-QUAL model have paid enough attention to students in the e-learning context. E-learning is a mutual process, thus understanding students’ perceptions and needs becomes essential. The next section will present students’ attitudes to e-learning, as well as their participation in e-learning.

Finding ways to encourage participation in e-learning has been defined as a key challenge in the research of e-learning, since participation has been proved as a factor that has an impact on learners’ satisfaction (Rovai 2002). E-learning participation is defined as learning and teaching facilitated and supported by
Internet technologies (Garrison & Anderson 2003). Moreover, Hrastinski (2008) maintains that e-learning participation does not only occur online but also takes place in offline study, because it requires time and energy to learn, communicate, think and assess what learners have obtained from e-learning communities. A research study conducted by Davies and Graff (2005) supports the above definition, as it finds out that students engaged in frequent online discussions do not necessarily have high grades. This particular finding suggests that e-learning participation requires both online and offline efforts.

Vonderwell & Zachariah (2005) identified four major factors that impact e-learning participation: technology and interface characteristics, content-area experience, student roles and tasks, and information overload. Technology and interface characteristics refer to students’ competency in negotiating technology and e-learning interface design. They found that adequate students’ skills and an active interface design lead to a high student participation rate. Content-area experience reflects students’ background knowledge related to e-learning courses. Students who have more background knowledge tend to take part in the whole learning process more actively and frequently. Online roles and tasks are related to the specific roles and tasks that students are assigned. The research reveals that students who are assigned specific roles and tasks, for instance facilitators and course reviewers, turn out to be more active throughout the process than others, since these roles and tasks demand more effort and input. In this case, these students believe they acquire more knowledge and skills than those who do not have specific roles and tasks. Information overload refers to students feeling overwhelmed due to the time consumed by online reading, discussion and assignments. Researchers (Vonderwell & Zachariah 2005) even found students who negotiated with their teachers to reduce the number of assignments and discussions. In this research, a number of students have shown a negative attitude to e-learning. Thus, it becomes vital to understand what students think about e-learning.
More and more universities and institutions offer e-learning subjects to their students as part of their diploma or degree study. It is believed that students’ attitude determines the final success of e-learning, given the fact that students aim to obtain knowledge via learning in both conventional and e-learning contexts successfully.

In 2006, researchers from the University of Western Sydney (UWS) conducted a research project aimed at investigating students’ attitude to e-learning (Arthur, Beecher, Elliott & Newman 2006). This project employed a survey and a focus group discussion to collect the data. They found that the usage rate and access to computers and the Internet are key issues. The research shows that the usage rate of computers and the Internet tends to decrease as students’ distance from the CBD of Sydney increases. Further, the research also indicates that economically disadvantage students may not have access to computers and the Internet off campus. Thus, they may not prefer e-learning as much as those who do not have economic constraints. According to this study, mature aged students do not feel confident with computers and ICT, while younger students tend to be more experienced than mature-aged students. However, face-to-face course delivery is still demanded by both mature and younger students, since they believe face-to-face delivery offers personal assistance and physical space for themselves. Based on the above information, researchers argue that there is an ethical dilemma. They question if it is correct to present e-learning to students without asking for their opinion; and if it is appropriate to introduce e-learning regardless of students’ economic and ICT experience constraints. Thus, researchers conclude that blended learning can be used as an approach for knowledge delivery, because it provides both face-to-face communication and flexibility to students (Arthur et al. 2006).
2.5 Concluding remarks

In this chapter, definitions of hypertexts and their special features have been discussed. This chapter has analysed two typical applications of hypertexts, known as blogs and wikis, in contemporary education. Hypertexts play an essential role in the e-learning context. This chapter has also reviewed definitions of e-learning, analysed and discussed critical success factors (CSFs) of e-learning, as well as summarised factors that influence the success of e-learning delivery.

First, there are two approaches to defining hypertexts discussed in prior studies, known as the functional approach and the semantic approach. Functional definitions describe hypertexts based on their technological components. In other words, functional definitions emphasise the arrangement of information displayed on computer screens. In this sense, readers’ roles and activities are not specified in functional definitions. On the other hand, semantic definitions define hypertexts based on their ability to establish linkages amongst different information chunks. Semantic definitions highlight readers’ activities (i.e. readers’ navigation activities and their selections of hyperlinks); therefore, information is organised based on readers’ understanding of given topics. In this respect, readers are active while reading hypertexts.

Secondly, hypertexts’ special features, including a new medium of reading, non-linearity, access to multimedia information, the “new roles” of readers in the hypertext world, as well as interactions between readers and authors, have been discussed. As a new medium of reading, hypertexts enable a large amount of information to be stored in a hypertext system. Also, timely information update and editing are allowed in the hypertext world. Hyperlinks allow readers to approach information in a non-linear manner. Thus, readers are able to read hypertexts in multi-sequences. Multimedia content is also available in the
hypertext world. While reading hypertexts, readers do not acquire information passively. They are able to control what they read and how they read. Hypertext readers can be browsers, users and/or co-authors according to their different purposes for reading. Moreover, readers are able to post their comments and communicate with authors while using blogs and wikis.

Thirdly, the chapter has also reviewed applications of blogs and wikis in the domain of education. Using blogs can facilitate students’ reflection in learning, since students need to read and comment on each other’s posts. Prior studies have confirmed that appropriate use of blogs in education, in conjunction with other Web2.0 technologies, can enhance students’ learning outcome. Wikis are used as an effective tool to get students engaged in collaborative learning tasks. It is also suggested that employing wikis in education can improve students’ participation, as well as their collaboration.

Finally, e-learning and the evaluation of its quality are key components of the present chapter. This chapter has reviewed definitions of e-learning, as well as the benefits of e-learning. In general, e-learning is a teaching and learning process, where knowledge is shared and distributed via the Internet, with the assistance of relevant ICT. Two e-learning-related models have been summarised: the Critical Success Factor model and the eQUAL model. These two models explore factors that affect the quality and success of e-learning. The Critical Success Factor model evaluates five categories of issues that have impacts on e-learning. The eQUAL model assesses factors that influence the quality of e-learning courses. Students’ participation in e-learning and their attitude also determine the final success of e-learning.

Overall, ICT and its rapid evolution have enriched instructional design, curriculum design and development, as well as pedagogical design in the domain of education. It brings benefits, but also faces criticism. In the following
chapter, the focus is on illustrating the process of hypertext comprehension based on existing theories. Also, factors that affect hypertext comprehension are analysed. The following chapter highlights the importance of teaching students to comprehend hypertexts using various comprehension strategies.
Chapter 3
Reading comprehension and metacognition in the hypertext context

As discussed in the previous chapter, reading is an important channel from which people get information and knowledge. Hypertexts have been widely applied for educational purposes as a result of the development of ICT. Thus, comprehending hypertexts is a vital skill for students to obtain knowledge in the Twenty First century. In this respect, teaching students strategies to comprehend hypertexts is a fundamental element in the domain of education (Afflerbach & Cho 2009). In order to comprehend texts successfully, readers employ various reading comprehension strategies. There are two widely discussed categories of reading comprehension strategies: cognitive strategies and metacognitive strategies. Cognitive strategies are methods readers use to extract meaning from what they read, while metacognitive strategies assist students in monitoring and evaluating their reading processes (O’Malley & Chamot 1990). Although the application of these strategies has been developed based on conventional print texts, they are still applicable when reading hypertexts. In addition, selecting hyperlinks is also an essential strategy in the hypertext reading context.

Solid reading comprehension theory models and research studies have been developed and conducted based on conventional print-based texts. Since the 1980s researchers have started to link existing theoretical models to hypertext reading, given the increasing use of hypertexts in the education sector. In this chapter, literature and theories related to reading comprehension are connected to their applications and development in the hypertext reading context. In relation to this, definitions of reading comprehension and reading comprehension strategies will be summarised, as well as influential theoretical frameworks of
reading comprehension and reading comprehension strategies. Levels of reading comprehension and factors that affect reading comprehension are presented. Finally, the definition of metacognition and its components, and the influence of metacognitive strategy training on hypertext reading comprehension, are also discussed.

3.1 The overview of reading comprehension

Researchers and scholars have been emphasising the importance of reading in the domain of education since the beginning of the XXth century (Thorndike 1917). So far, many researchers and scholars have defined reading comprehension in their studies or theoretical models. In general, reading comprehension is defined as the process of interpreting new information and storing it into a reader’s current knowledge base (Anderson & Pearson 1984). Hypertexts have become a common platform for presenting information, and as such, researchers have defined reading comprehension in the hypertext context. Hypertext reading comprehension refers to navigating through hypertext systems, selecting hyperlinks and interpreting information displayed on computer screens (Slatin 1990). In this section, reading comprehension is discussed under two theoretical models with their applications in recent studies. These two models are:

- The simple view of reading;
- The definition of reading comprehension from RAND group.

The above two models will be analysed and discussed in section 3.1.1 and section 3.1.2 respectively.

3.1.1 The simple view of reading

Early research studies maintain that reading comprehension is a complex
process that requires a substantial amount of mental effort on behalf of readers (Hoover & Gough 1990). Hoover and Gough’s (1990) model suggests that reading comprehension consists of two fundamental components, known as decoding and linguistic comprehension. Neither decoding, nor linguistic comprehension alone, is sufficient enough for reading comprehension to occur. Reading comprehension only happens when both decoding and linguistic comprehension happen.

Decoding
In the simple view of reading, decoding refers to word recognition. At this stage, readers need to translate meaningless sets of letters into recognisable objects and form an appropriate mental lexicon, and retrieve the semantic information at the word level. In this respect, readers need to decide and clarify what each word refers to in their minds, and build proper relations amongst these words (Gough, Hoover & Peterson 1996; Hoover & Gough 1990).

Linguistic comprehension
In the simple view of reading, linguistic comprehension is described as the ability to obtain semantic information at the word level and be able to extract an interpretation of what has been read. However, linguistic comprehension also includes people’s interpretation of what they hear. In order to achieve reading comprehension specifically, readers should also rely on receiving graphic-based information from their eyes.

Gough, Hoover and Peterson (1996) present a formula of reading comprehension: Reading comprehension = decoding X linguistic comprehension. Scales of reading comprehension, decoding and linguistic comprehension are from zero to one. Reading comprehension only happens when both decoding and linguistic comprehension are larger than zero. If decoding approaches one, then reading comprehension equals linguistic comprehension. If linguistic
comprehension approaches one, then reading comprehension equals decoding.

Although researchers maintain that neither decoding nor linguistic comprehension is sufficient on their own, they also argue that decoding and linguistic comprehension is separable. Gough, Hoover and Peterson (1996) argue that a 5-year-old Italian child is able to understand Italian but unable to decode it. In contrast, an adult English native speaker may be able to decode some Italian words but achieve little comprehension. Hoover and Gough (1990) spent five years carrying out a research study and collecting data aimed at exploring the correlation between decoding skills and linguistic comprehension skills. They recruited 254 students, tracking their reading comprehension patterns from grade one to grade four. All participants’ reading comprehension performances were tested by using the Interactive Reading Assessment System (Calfee & Calfee 1979, 1981; cited in Hoover and Gough 1990). The results of the study revealed that students who were good at decoding and linguistic comprehension tended to be good at reading comprehension. On the other hand, students who were poor at the above two skills tended to perform poorly in reading comprehension.

Some researchers argue that the simple view of a reading model is only applicable to students at elementary level (Tilstra, McMaster, Van den Broek, Kendeou & Rapp 2009). Tilstra and her research colleagues (Tilstra et al. 2009) conducted a research project to explore the validity of the simple view of reading beyond the elementary level of education. They recruited 271 students from grade four, grade seven and grade nine. There were equal portions of struggling, average and good readers from each grade level, based on the Curriculum-Based Measurement (CBM) maze reading task. Participants’ reading comprehension performance was tested by the Gates-MacGinitie Reading Comprehension test, the Iowa Test of Basic Skills (ITBS), as well as CBM. The results of this research revealed that decoding and linguistic comprehension
skills are essential for successful reading comprehension across all three grade levels. Decoding tended to play a more important role in reading comprehension in the lower grades than in higher grades. In comparison, the higher students’ grades were, the more they relied on linguistic comprehension while reading (Tilstra et al. 2009).

Although Tilstra et al.’s (2009) study has proven that the simple view of reading is applicable to students in secondary education, few prior studies have tried to confirm the validity of this model on a broader scale. The RAND reading group developed a framework using three components to illustrate the process of reading comprehension. The next section analyses and discusses the definition proposed by the RAND research group.

3.1.2 RAND reading comprehension model
The RAND Reading Study Group conducted a research project in 2002 aimed at defining reading comprehension, exploring current challenges and proposing a research agenda for reading comprehension instruction. They define reading comprehension as “the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (Snow 2002, p.11). In order to complete this process of reading comprehension, there should be three elements:

- The reader who comprehends a text;
- The text that is read by the reader;
- The activity that includes comprehension.

The reader
In order to achieve comprehension, a reader should have a number of key capabilities and abilities. These key capabilities and abilities involve cognitive
capabilities, motivation and various types of knowledge. Cognitive capabilities include a reader’s attention, memory, critical analytic ability, inferencing and visualisation ability. Motivation consists of a purpose for reading, a reader’s interest in the content, and his/her self-efficacy. A reader’s knowledge includes his/her vocabulary, domain prior knowledge, linguistic and discourse knowledge, as well as knowledge of reading comprehension strategies.

Snow (2002) suggests that readers’ key reading capabilities and abilities interact dynamically with each other while readers comprehend texts. Comprehending texts may increase readers’ domain prior knowledge, as well as their linguistic and discourse knowledge. Further, their motivation for reading might change as they continue reading. Their interest on certain topics may increase or decrease as they read. Moreover, it should be noted that appropriate instruction on reading comprehension strategies from teachers also improves students’ knowledge about comprehension strategies and their fluency of reading. Snow (2002) argues that certain components of fluency, such as efficient word recognition, are considered to be the prerequisites of reading comprehension.

Readers’ working memory is a key factor that impacts on their hypertext reading performance (Lee & Tedder 2003). Text recall is used as a comprehension measurement. The conclusion of Lee and Tedder’s (2003) study indicates that readers who possess high working memory can recall more information from hypertext reading than those who have low working memory. The conclusion implied that differences in readers’ working memory could lead to differences in hypertext comprehension performance. Besides working memory, readers’ prior knowledge also affects their hypertext reading comprehension. Effects of diversified working memory capacity and levels of prior knowledge will be elaborated in section 3.6.1.2 and section 3.6.1.3.
The text
Readers get information and knowledge from texts. Levels of difficulty depend on how texts are organised and presented. The vocabulary load of a text, its linguistic structure, discourse style and genre, all influence readers’ comprehension performance. If none of these features match readers’ prior domain knowledge and fluency, the text is too difficult to read (Snow 2002).

It is also suggested that the use of electronic texts, for example hypertexts, has expanded the traditional definition of texts. New text elements, such as multimedia content and electronic links, are included in electronic texts. Thus, reading electronic texts poses opportunities and challenges for teachers and students (Snow 2002).

In the hypertext environment, readers interact with what they read more actively than in the traditional written-texts context. The provision of hyperlinks enables readers to select and determine their own reading sequences. In other words, readers can formulate their own texts in the hypertext context. On the one hand, researchers argue that this non-linear fashion of reading parallels how people process information in their minds. On the other hand, readers are exposed to reading difficulties because of the large amount of information, and the accessibility of hyperlinks (Snow 2002).

The activity
A reading activity consists of “one or more purposes of reading, some operations to process the text at hand, and the consequences of performing the activity” (Snow 2002, p.15). First, purposes for reading are closely linked to reading activities. Readers may have different purposes before they commence reading. These purposes can either be externally imposed or internally generated. For those externally imposed purposes – for example, reading a passage and answering questions – readers may engage in reading to accomplishing these
tasks. For those internally generated purposes – for example, reading a story for leisure – readers’ reading activity may be related to raising questions about scenarios and characters in the story. Secondly, readers read texts based on their purposes. Their reading processes include decoding, higher-level linguistic and semantic processing and monitoring. In this sense, readers achieve different levels of comprehension. Levels of reading comprehension will be discussed in Section 3.4 in this chapter. Finally, reading activities can lead to a variety of consequences for the reader. They may increase readers’ knowledge on certain topics. They may encourage readers to apply new knowledge they obtain from reading. They may engage readers in certain topics or types of texts. Also, knowledge and/or applications readers get from reading activities can become part of their prior knowledge in their future reading experiences (Snow 2002).

Reading hypertexts also includes searching activities, which require readers to select information based on their initial purposes for reading online. Similarly, hypertext readers may apply the knowledge and information they get online in their daily lives. However, online information may lack accuracy. For instance, information displayed in Wikipedia (which is a type of wiki technology) comes from contributions of various online readers. Thus, it is difficult to guarantee the accuracy of this information (Thurstun 2004).

Apart from the reader, the text and the activity, reading comprehension is affected by the sociocultural context of readers. Readers start learning to read in conjunction with their interaction with their sociocultural contexts. For instance, classroom instructional materials and resources may be determined by economic disparities of a region. Instructional materials and resources can have impact on how students comprehend texts. Thus, readers interact with the surrounding sociocultural environment while reading (Snow 2002).

In general reading comprehension refers to understanding and interpreting
written texts (Vellutino 2003). However, reading comprehension is considered to be a complex mental process (Westwood 2000). In order to achieve this complex process, readers need to employ some strategies. The next section looks at four categories of reading comprehension strategies and their applications in the hypertext reading environment.

3.2 Reading comprehension strategies

Reading comprehension strategies refer to methods or attempts readers make in order to decode texts, understand words and sentences, as well as construct the meanings of texts. Reading comprehension strategies are goal-oriented tools to assist readers in interpreting what they read (Afflerbach, Pearson & Paris 2008). Some research studies use the terms ‘reading skills’ and ‘reading strategies’ interchangeably. However, reading skills are automatic mental actions of decoding and comprehending texts in a fluent and swift manner. Normally readers are not aware of these. On the other hand, readers select, evaluate and adjust reading comprehension strategies during their reading processes. In other words, readers do not have deliberate control over their reading skills; however, they are conscious of what reading strategies they use. If readers apply reading strategies frequently, these strategies may gradually become part of their reading skills (Afflerbach et al. 2008).

O’Malley and Chamot (1990) classified reading strategies into three categories based on levels of reading processes. They are cognitive strategies, metacognitive strategies and social/affective strategies. Cognitive strategies focus on handling new information from reading and generating comprehension. Metacognitive strategies look at organising and monitoring reading processes and evaluating comprehension results. When applying social/affective strategies, readers communicate with each other and exchange opinions (O’Malley & Chamot 1990).
Apart from O’Malley and Chamot’s (1990) model, the discussion of link selection strategies is included in this section as well. Link selection strategies assist readers in organising and formulating their own texts in the hypertext context in particular. There are three categories of hyperlink selection strategies: coherence, interest and default screen positions (Salmeron, Kintsch & Kintsch 2010). Detailed explanations and the influence of the above three criteria on comprehending hypertexts will be elaborated in section 3.2.4.

3.2.1 Cognitive strategies
Cognitive strategies describe readers’ behaviours that operate on and manipulate incoming information and knowledge to enhance reading performance (O'Malley & Chamot 1990). Cognitive strategies cover a broad scale of methods that readers can employ, in order to produce comprehension. O’Malley and Chamot’s (1990) model involves eight frequently used cognitive strategies. They are:

- Rehearsal: repeating names of what is to be read and/or learnt;
- Organisation: grouping and classifying words, terminology or concepts according to their semantic or syntactic attributes;
- Making Inference: using information in the text to guess meanings of new linguistic items, predict outcomes, or complete missing parts;
- Summarising: intermittently synthesising what one has read to ensure the information has been retained;
- Deducing: applying rules to text understanding;
- Imagery: using visual images (either imaginary or actual) to understand and remember new information;
- Transfer: using known information to facilitate new reading tasks;
- Elaboration: linking ideas contained in new information, or integrating new ideas with known information.
The above strategies are explained in detail as follows.

3.2.1.1 Rehearsal

When applying this strategy, readers keep repeating a list of key information and/or marking materials to be read or learnt (Mulcahy-Ernt & Caverly 2008). This strategy is linked to goals of reading. Goals of reading offer the reader an idea of key information to pay attention to (McNamara, Ozuru, Best & O'Reilly 2007b). It is also suggested that highlighting or underlining key information according to goals is the application of the rehearsal strategy. Highlighting or underlining helps readers identify selective important sections of what they read and focus on these sections in order to accomplish goals of reading (Mulcahy-Ernt & Caverly 2008).

3.2.1.2 Organisation

This strategy assists readers in recalling the structure of the information. In order to achieve this, readers could outline or map terminologies, words or concepts based on their attributes (Chamot & O'Malley 1996). Mulcahy-Ernt and Caverly (2008) maintain that the organisation strategy is a complex but beneficial approach when readers are dealing with long texts. It allows readers to visually review main ideas of texts. In order to do so, readers could use various graphic organisers, such as concept maps, flowcharts, timelines and tables.

3.2.1.3 Making inference

Making an inference requires readers to go beyond what is expressed in a text (Cain & Oakhill 1999). It is assumed that proficient readers should be able to make inferences whenever necessary (Cain & Oakhill 1999). Different types of inferences lead to reading comprehension. The most used types of inferences include:

- Bridging inferences;
• Predictive inferences;
• Elaborative inferences.

1) Bridging inferences
Bridging inferences are described as mental activities that lead readers to make connections between information from current and previous texts (King 2007). Bridging inferences are considered to be a simple type of inference. Readers employ bridging inferences to establish connections amongst information that is explicitly stated in a text (Zwaan & Singer 2003). Thus, bridging inferences are believed to be necessary for comprehension to take place (Tapiero 2007). It is also argued that bridging inferences take place automatically (King 2007).

2) Predictive inferences
Predictive inferences, a type of complex inference, refer to readers forecasting what will happen next and constructing a richer understanding of a text (Allbritton 2004). It is suggested that readers’ goals or purposes for reading influence the production of predictive inferences. Researchers also argue that readers make more predictive inferences when they read to learn than when they read for fun. Moreover, Allbritton (2004) remarks that reading comprehension strategies used by readers also affect the construction of predictive inferences. Comprehension strategies that encourage readers to guess what they will read next, such as predicting, lead to accurate predictive inference making.

3) Elaborative inferences
Elaborative inferences are ideas that are highly implied by a text, but which have no influence on establishing the coherence of the text (Zwaan & Singer 2003). It is argued that elaborative inferences make connections between a reader’s prior knowledge and new information expressed in a text (King 2007). Reading comprehension theorists also maintain that making elaborative inferences affects the construction of higher levels of mental representations. Relevant theories will
be discussed in section 3.5.

3.2.1.4 Summarising
Summarising is to identify main ideas of texts. It directs readers to record their interpretations during and after reading (Mulcahy-Ernt & Caverly 2008). Hock and Mellard (2005) suggest five steps to summarise what readers have read. They are to determine the most important sections of a text, select some information, delete some information, condense some information, and then integrate some information into the summary. In this respect, it is argued that summarising enhances students’ skills to find main ideas, improves comprehension performance, as well as test performance (Mulcahy-Ernt & Caverly 2008). Also, summarising is considered to be the reading comprehension strategy that should be taught to post-secondary students in order to enhance their understanding of learning materials (Mulcahy-Ernt & Caverly 2008).

3.2.1.5 Deducing
Deducing is to apply rules to understand a concept or complete a learning task (Chamot & O'Malley 1996). McNamara et al. (2007b) argue that deducing helps readers to figure out relationships between word meanings. It may be used by readers in order to interpret what is implied by the text, and/or investigate logical sequences of ideas presented in the text.

3.2.1.6 Imaging
Imaging, or visualising, is to establish mental images based on readers’ prior knowledge (Onofrey & Theurer 2007). Visualising enables readers to go beyond the text by evoking their prior knowledge (McNamara et al. 2007b). There are three steps to build mental pictures of what is expressed in the texts: reading short sections of the text, formulating images or pictures in mind of what has been read, and evaluating and refining mental pictures or images accordingly
(Hock & Mellard 2005). The above steps are supported by Onofrey and Theurer’s (2007) instruction suggestions. They advise teachers to start teaching the visualising strategy from selecting a small portion of a text. As soon as students become proficient with applying the visualising strategy, they would visualise what they have been reading as they comprehend the text.

3.2.1.7 Transferring
Chamot and O’Malley (1996) define the transferring strategy specifically as “students recognise and use similarities between their native language and English” (p. 264). It implies that this strategy is to be used by students whose first language is not English. McNamara et al. (2007b) maintain that readers could also apply outside sources to assist their comprehension processes, such as looking up a dictionary or a reference book, regardless their language backgrounds. Furthermore, the wide spread of ICT has allowed students to transfer online information into their comprehension of texts. Students could search certain topics or concepts on the Web in order to obtain their own interpretations when they encounter complex terms in texts (McNamara et al. 2007b).

3.2.1.8 Elaboration
Elaboration is to relate new knowledge to readers’ prior knowledge (Holschuh & Aultman 2008). Nowadays, more and more learning tasks require students to make connections amongst online sources, print-based sources and mainstream subjects. Students use this strategy to integrate newly learnt knowledge into their existing knowledge base. Students could start from self-questioning in order to apply the elaboration strategy effectively, since self-questioning could evoke students’ prior knowledge of selected topics.
3.2.1.9 Paraphrasing
Paraphrasing is another popular cognitive strategy, even though it is not included in O’Malley and Chamot’s (1990) model. Paraphrasing is to re-word or re-write what readers have read in their own words and expressions. There are three steps to utilize the paraphrasing strategy successfully: reading the text, asking “What was the main idea” and putting the answer into readers’ own words (Hagaman & Reid 2008). McNamara (2004) argues that inaccurate paraphrasing could lead to poor comprehension. Paraphrasing helps readers to indicate reading difficulties. If readers identify reading difficulties by using the paraphrasing strategy, they could apply other strategies, such as using external sources, to achieve comprehension (McNamara et al. 2007b).

3.2.1.10 Applying cognitive strategies in the hypertext context
While reading hypertexts, it is suggested that two types of cognitive strategies are particularly useful: organisation strategies and elaboration strategies (Naumann, Richter, Christmann & Groeben 2008). Organisation strategies and elaboration strategies are sub-groups of cognitive strategies proposed by van Dijk and Kintsch (1983). Organisation strategies assist readers in grasping semantic structures of texts – that is, the topical and the conceptual structures of texts. Examples of organisation strategies include paraphrasing and summarising. When reading hypertexts, readers apply organisational strategies to understand how hypertext nodes and links are structured and connected. According to van Dijk and Kintsch (1983), elaboration strategies help readers apply their background knowledge while reading. Such strategies contain inferencing, elaboration, and visualising. In the hypertext context, elaboration strategies support readers to build conceptual relationships amongst contents in various nodes.

Munro and Verezub (2011) conducted a study on exploring the influence of cognitive reading comprehension strategies on comprehending hypertexts by
elementary students in different age groups (Grade 3 and Grade 6 students). There were three phases in the study, known as the pre-instructional phase, the instructional phase and the post-instructional phase. At the pre-instructional phase, students were given linearly structured hypertexts followed by comprehension tasks. Students were taught cognitive strategies at the instructional phase in small groups. Cognitive strategies taught in the study were summarising, paraphrasing and predicting. Participants received training sessions on applying summarising, paraphrasing or predicting strategies to read hypertexts. At the post-instructional phase, students were tested on their hypertext comprehension performance under the same conditions as the pre-instructional phase. The results of this study revealed that the ‘training to predict’ instruction improved Grade 3 students’ hypertext comprehension performance. On the other hand, the ‘training to summarise’ instruction enhanced six graders’ hypertext comprehension performance (Munro & Verezub 2011).

Sung, Chang and Huang (2008) completed a study using computer-based strategy training to enhance Grade 5 and Grade 6 students’ hypertext comprehension performance. The study involved 130 children, 65 of whom were assigned to the experimental group, with the others assigned to the control group. A comprehension strategy-training tool, called Computer Assisted Strategy Teaching and Learning Environment (CASTLE), was developed for this study specifically. Twenty-two 50-minute instruction sessions were delivered to students in 11 weeks. Examples of strategies taught by CASTLE included self-questioning, inferencing, and elaborating. From session one to session eleven, participants were taught one cognitive strategy per session. Participants received strategy instructions and reading comprehension exercises from CASTLE, as well as obtaining feedback on their performance. From session thirteen to session twenty-two, participants revised what they had learnt with CASTLE. All instructions and hypertext reading comprehension exercises were written in traditional Chinese. The results of this study highlighted that
participants in the experimental group applied various strategies more frequently than those who were in the control group. In terms of hypertext comprehension performance, participants in the control group outperformed those in the experimental group conditionally. For instance, while applying the inferencing strategy, the experimental group only outperformed the control group when they were reading expository articles. This was not the case when they comprehended narrative texts. Researchers argued that expository texts normally have more complex structures than narrative ones; thus, the inferencing strategy worked better when children were reading expository texts.

Comparing Munro and Verezub’s (2011) study with Sung et al.’s (2008) study, a major similarity between them is that reading comprehension strategy training enhanced elementary students’ hypertext comprehension performance. However, Munro and Verezub (2011) employed a traditional face-to-face instructional approach, whereas Sung et al. (2008) used computers to deliver instructions. Sung et al. (2008) provided longer training and taught more strategies than Munro and Verezub (2011). Munro and Verezub (2011) compared participants’ comprehension performance across two grades, Grade 3 and Grade 6, whereas Sung et al. (2008) compared participants’ hypertext comprehension performance across two groups, the experimental group and the control group.

3.2.2 Metacognitive strategies
Metacognitive strategies have been developed based on the notion of metacognition. Metacognition was first introduced in the late 1970s. In this section, metacognition and its application in the hypermedia environment and e-learning are summarised and discussed. Metacognitive strategies and their applications in the hypertext context are also presented.

3.2.2.1 The overview of metacognition
The concept of metacognition was first introduced by Flavell (1979). He
described metacognition as “knowledge and cognition about cognitive phenomena” (Flavell 1979, p. 906). Flavell (1979) also suggested the importance of metacognition in both the education and psychology fields, where skills such as reading comprehension, language acquisition, writing, attention, memory, and self-control are required. The definition of metacognition has been developed and expanded as further in-depth studies have been conducted. Baker and Brown (1984) noted that there are two clusters of metacognitive activities: knowledge about cognition and regulation of cognition. Knowledge about cognition focuses on a reader’s own awareness and appraisal of his/her cognitive process. In this regard, readers should know their prior knowledge is essential to achieve comprehension. They should know how to connect prior knowledge with texts, and how to adjust reading rates to meet their purposes for reading. Regulation of cognition takes into account self-regulation, and strategies that lead to the achievement of self-regulation. In this case, readers plan, monitor and evaluate their reading processes. Moreover, they assess the outcome of their reading comprehension (Baker & Brown 1984).

Samuels et al. (Samuels, Ediger, Willcutt & Palumbo 2005) acknowledged that there were three elements that constitute metacognition, including: personal cognitive processes; the nature of the task that learners are expected to carry out, and various approaches to achieve it under different circumstances; and strategies that enable learners to monitor and regulate their cognitive processes. In comparison to Baker and Brown’s (1984) statement, Samuels et al. (2005) put emphasis on the nature of the task, which also implied that learners should choose metacognitive strategies accordingly, in order to achieve the task. In fact, Baker and Brown (1984: p. 354) have a similar statement regarding the relationship between the task and strategies: “Strategies vary, depending on the goal of the activity.” Therefore, metacognitive strategies play crucial roles in learning achievement. Furthermore, with the development of hypertext/hypermedia and e-learning, the importance of metacognitive strategies
becomes obvious (Lee & Baylor 2006; Verezub, Grossi, Howard & Watkins 2008).

Prior research studies that addressed the importance of metacognition in comprehending conventional print texts are substantial and solid (e.g. Baker & Brown 1984; McNamara 2004). Given the core of this chapter is to discuss hypertext reading comprehension, the following three sections will analyse studies that examine applications of metacognition in reading hypertexts and conducting e-learning.

3.2.2.2 Metacognition and learning with hypermedia

As suggested by Baker and Brown (1984), readers’ regulation of their cognition is an important component of metacognition. Thus, it is argued that readers’ self-regulation plays an essential role while reading hypertexts (Oliver & Herrington 1995). Self-regulation refers to goal oriented mental processes in which readers control and monitor what they read and how they read (Oliver & Herrington 1995).

Azevedo and his research fellows have conducted a number of research studies to examine the influence of teaching students to apply self-regulation while learning in a hypermedia context. Moos and Azevedo (2008) carried out a research study, focusing on exploring the relationship between readers’ prior knowledge and their hypermedia learning performance in light of self-regulation. Researchers recruited 49 undergraduate students to take part in the study. In the pre-test, participants’ levels of prior knowledge of a given topic were tested. Participants then received a training session related to how to use the hypermedia system. In the training session, participants were reminded to speak out their instant understanding of what they read. The training session was followed by a 40-minute post-test, in which the think-aloud protocol was used to collect data on participants’ self-regulation. The results indicated that participants’
self-regulation when learning with hypermedia is significantly influenced by their prior knowledge of given topics. It is concluded that participants with high prior knowledge tend to use metacognitive strategies, such as planning and monitoring, while learning with hypermedia, whereas participants with low prior knowledge tend to rely on cognitive strategies, such as summarising, to obtain online information. Moos and Azevedo (2008) articulate that participants with high prior knowledge possess readily available knowledge in their knowledge bases; thus, they verify online information while learning with hypermedia. On the other hand, low knowledge participants do not have much readily available knowledge; thus, they obtain knowledge online and store it in their knowledge bases. This conclusion also highlights the importance of prior knowledge in comprehending texts (including conventional print texts and hypertexts), which parallels RAND groups’ definition of reading comprehension (Snow 2002).

As well as being applied in learning with hypermedia, metacognition has been more and more integrated into e-learning. Tsai (2009) introduced a theoretical model on strategic e-learning in light of metacognition. It is summarised and discussed in the following section.

3.2.2.3 Metacognition and e-learning
Tsai (2009) introduced a Strategic e-Learning model in light of metacognition, based on in-depth interviews with 14 senior university students. In this model, there are three domains of e-learning strategies: perceived-skill, affection, and self-regulation. Perceived-skill includes hypertext reading comprehension, Internet skill and self-awareness. It is argued that comprehending online texts is an essential skill that e-learning students must master. Moreover, e-learning students are required to have fundamental Internet skills to accomplish tasks associated with e-learning. In terms of self-awareness, e-learning students need to be aware of their roles and responsibilities in an e-learning community. It is their metacognition that informs e-learning students of their obligations and
responsibilities. Affection consists of attitude, motivation and anxiety. This domain is highly connected to students’ perceptions of e-learning, which can lead to different learning outcomes. Prior studies have formed solid conclusions on the influence of e-learners’ attitude and perceptions on e-learning participation and outcomes (Section 2.4.5). Self-regulation includes monitoring, time management and concentration. Metacognition plays a vital role in this domain. E-learning students should be able to organise and monitor their e-learning processes based on their learning objectives. Furthermore, they need to plan and organise their time effectively, in order to maximise their online learning outcome. In addition, metacognition also keeps e-learning students concentrating on learning materials, instead of being distracted by online multimedia contents (Tsai 2009).

The Strategic e-Learning Model highlights essential skills and strategies that e-learning students need to possess and employ to maximise their online learning outcome (Tsai 2009). However, Tsai’s research study (2009) was designed and conducted based on a qualitative research approach. All data was obtained by using interviews. The application of this new model in e-learning communities remains to be justified by further studies.

As mentioned above, metacognitive strategies have been developed based on metacognition and its applications in the domain of education. The following section summarises and discusses metacognitive strategies identified by researchers and scholars, as well as their applications in reading comprehension.

3.2.2.4 Metacognitive strategies

Metacognitive strategies refer to readers’ mental activities that control their reading processes. Readers use metacognitive strategies to monitor and evaluate what they have read. Application of metacognitive strategies enables readers to assess how much they have comprehended, and detect
comprehension failures. Readers can also adjust their usage of cognitive strategies in light of metacognitive strategies (O'Malley & Chamot 1990). O'Malley and Chamot (1990) identified four metacognitive strategies, including:

- Selecting key aspects of reading materials based on purposes of reading;
- Planning the organisation of the written discourse;
- Monitoring comprehension processes;
- Evaluating what has been read and checking if comprehension occurs.

Besides O'Malley and Chamot (1990), other researchers also discuss metacognitive strategies. Although worded differently, the core issues remain similar. For example, Palincsar and Brown (1989) noted six metacognitive strategies that both monitor and foster comprehension, including:

- Clarifying the purposes of reading to determine the appropriate approach to the reading activity;
- Activating background knowledge to create links between what is known and the new information presented in the text;
- Allocating attention so that the major content becomes the focus;
- Evaluating content critically for internal consistency and compatibility with prior knowledge and common sense;
- Monitoring comprehension processes in order to determine if comprehension occurs;
- Drawing inferences and testing them.

The above two sets of metacognition strategies share three similarities. First, they both stress the importance of planning if readers want to read metacognitively. Secondly, the importance of monitoring is the core of both frameworks. Lastly, the function of evaluating the reading processes is also considered to be a key element in both frameworks.
Verezub and her research fellows (Verezub et al. 2008; Verezub & Wang 2008) carried out a research program aimed at exploring the effects of metacognitive strategies on comprehending hypertexts. There were five phases included in this research, involving a pre-test, three training sessions and a post-test. Metacognitive strategies instructed in three training sessions were based on the six strategies proposed by Palincsar and Brown (1989). The results revealed that metacognitive strategies training did enhance participants’ hypertext comprehension performance significantly. Thus, this research has identified the importance of training in assisting students in comprehending hypertexts. Section 3.6 will analyse and discuss various training programs that aim at improving students’ use of metacognitive strategies.

O’Malley and Chamot’s (1990) and Palincsar and Brown’s (1989) metacognitive strategies models, summarised above, were designed when comprehending print-based texts dominated. Lee and Baylor (2006) use four key strategies that are proposed by Brown (1987, cited in Lee & Baylor 2006) to illustrate the importance of metacognition in the hypertext reading environment. These four strategies include planning, monitoring, evaluating, and revising. Planning describes an overview of how the reading event will be carried out. Monitoring is to control the undergoing reading process. Evaluating refers to the assessment activities of current reading. Revising involves activities to correct previous mistakes and adjust previous learning plans and other strategies. Finally, Lee and Baylor (2006) suggest that the application of metacognition in the hypertext reading context can not only enhances comprehension outcome, but also reduces disorientation. The phenomenon of disorientation in the hypertext environment will be discussed in detail in Section 3.6.

3.2.3 Social/affective strategies
Social/affective strategies refer to interactions and cooperation amongst students
and teachers (O’Malley & Chamot 1990). In general, three strategies are included in this category:

- Working with peers to solve problems and getting feedback from them;
- Seeking clarification from teachers or tutors;
- Self-talking to control students’ own reading processes and reduce anxiety.

Blogs are considered to be one typical example of where hypertexts enable peer interaction and feedback in the context of hypertexts (Xie et al. 2008). If blogs are used for educational purposes, students are asked to write posts based on their coursework, and evaluate their peers’ posts. As well, teachers and students interact via blogs on their coursework. It is suggested teaching and facilitating classroom activities play an important role for utilising blogs. Moreover, prior research studies have noted that using the combination of blogs and wikis for knowledge delivery can potentially enhance students’ understanding of subject-matter materials.

As online learning materials are increasingly used for educational purposes, strategies that assist students in reading and interacting with hypertexts become crucial. The next section discusses such strategies in detail.

3.2.4 Reading and interacting with hypertexts

Hypertexts are non-linear electronic texts that contain hyperlinks. In order to carry on reading, readers need to make their own decisions to select hyperlinks. Besides, the Web has searching functions that enables readers to find and collect the information they want. In this respect, readers should also master information searching skills. This section elaborates strategies that help students choose hyperlinks, as well as strategies that enhance their online searching outcome.
3.2.4.1 Link selection strategies

In order to comprehend hypertexts, readers need to select links to formulate their own online texts. Thus, Salmeron et al. (2005, p. 174) suggest “reading comprehension strategies in hypertext can be considered as the decision rule that a reader follows to navigate through the different nodes of a hypertext”. In the context of hypertext reading, readers navigate through hypertext systems instead of turning pages. As links and nodes are linked in a non-linear fashion, the pathways chosen by different readers will vary. Based on prior studies by Lawless and Kulikowich (1996), Rezende and de Souza Barros (2008) suggest three different types of navigation patterns used by students. They are organised navigation, conceptual navigation and disoriented navigation. In organised navigation, students tend to take the advantage of navigational tools offered by the hypertext system to support their navigation and link selection. Conceptual navigation refers to students searching in the system in order to collect and understand information online. Disoriented navigation refers to students having no meaningful interactions with hypertexts and getting lost in the system (Rezende & de Souza Barros 2008).

It is argued that link selection strategies have impacts on the results of hypertext comprehension, since they influence how readers link ideas and information in hypertexts (Salmeron, Kintsch & Canas 2006a; Salmeron et al. 2006b). Three criteria of link selection strategies have been addressed in prior research: coherence, interest and default screen positions (Salmeron et al. 2010). The coherence strategy refers to readers choosing hypertext links that are semantically related to each other. The interest strategy describes the phenomenon where readers choose links that interest them, and discriminate links that are less interesting. The default screen position strategy is defined as readers selecting links based on their physical positions on the computer screen while reading hypertexts (Salmeron et al. 2010). Prior research studies have disclosed that these strategies influence the outcome of hypertext reading.
comprehension.

Salmeron and his research colleagues (Salmeron et al. 2006a) conducted a series of research studies to explore the influence of coherence and interest strategies on comprehending hypertexts. In their studies, participants were exposed to one hypertext node, at one time, with two links. One of the two links was highly semantically related to the previous text, whereas the other link’s semantic relationship with the previous text was low. Students did not know the distinction between these two types of links. Data was collected from participants’ comprehension scores on comprehension assessment. Furthermore, researchers also included participants’ prior knowledge as a variable in their data analysis. Participants’ prior knowledge on the topics being read was tested before they commenced reading hypertexts. The conclusion of this series of studies revealed that the coherence strategy improves hypertext reading comprehension regardless of participants’ levels of prior knowledge. This is because the coherence strategy allows readers to connect information fragments and build appropriate mental representations of hypertexts. On the other hand, the interest strategy may benefit hypertext readers with high levels of prior knowledge, but hinder the comprehension of those who have low levels of prior knowledge. This happens because the interest strategy may lead readers to discriminate between those links that are of interest and of no interest. However, those less preferred links might be those links that are semantically related to the previous text. In this regard, readers with low prior knowledge may not be able to establish proper mental representations of hypertexts being read (Salmeron et al. 2006a).

Protopsaltis (2008) conducted a research study to investigate the influence of the default screen position strategy on comprehending hypertexts. This project used the think-aloud protocol to get participants’ reactions and application of strategies while encountering hypertexts. Hyperlinks used in this project were hierarchically structured hypertexts. There are four strategies that participants employed,
including a serial strategy, a serial overview strategy, a mixed strategy and a mixed overview strategy. A serial strategy refers to readers clicking on the first link that comes across while reading online. A serial overview strategy describes readers selecting the first link they encounter with occasional quick scans on other links. A mixed strategy is where readers sometimes choose the first link they encounter while selecting other links in a random fashion. A mixed overview strategy refers to readers scanning the online document before and/or during reading. In this strategy, readers select links in a mixed manner (i.e. sometimes they choose the first link they read, sometimes they click on links randomly). The results revealed that over 85% of participants selected the first link they encountered while reading hypertexts. In other words, the position of links on computer screens is an important influence on hypertext readers’ link selection decisions. Protopsaltis (2008) also concluded that coherence and personal interest are two factors that have an impact on hyperlink selection. While Protopsaltis (2008) emphasised the importance of coherence and personal interest in navigation, he did not use participants’ prior knowledge of hypertext topics as a variable. In this regard, his research did not specify if readers’ prior knowledge would affect their hyperlink choices based on the four strategies in his research.

### 3.2.4.2 Information searching strategies

Contemporary students rely on the Web to search and locate the information they want for different purposes (Zhang & Duke 2008). Searching strategies used by students vary due to different reading purpose. Zhang and Duke (2008) investigated proficient Internet users’ strategies under three conditions: locating specific information, acquiring general knowledge, and being entertained.

When locating specific information, these readers would go to a specific search engine, such as Google, input keywords based on the information they need, and then scan through the results page and evaluate the relevance of these results to
what they need. As soon as they select one relevant website, readers would keep
the reading goal in mind and scan the whole website with the help of a site map. Hypertexts that are relevant to their reading purposes would be read closely. These relevant texts would be evaluated by readers. If the information is not informational or readable, they would leave the website immediately and refine their key words in order to start re-searching (Zhang & Duke 2008).

If the online reading and searching purpose is to acquire general knowledge, sophisticated users would input their keywords into a search engine, such as Google, and scan through the result page. When they select relevant website, they would evaluate the degree of difficulty of hypertexts before they start reading them closely. Also, they would monitor what they read carefully and re-read these hypertexts if necessary. Some readers would even apply their prior knowledge to evaluate the credibility of websites they have chosen (Zhang & Duke 2008).

When reading for being entertained, they would go to a specific website without consulting any search engines. The reading and navigation procedures follow their emerging interests. When reading for entertainment, readers would have their focused topics in mind. Sometimes, they would scan the website and browse headlines (Zhang & Duke 2008).

Zhang and Duke’s (2008) study indicates that strategies for searching and reading online materials for information acquisition purposes include:

- Identifying keywords and input them into a search engine;
- Browsing the results page and making selections based on the relevance between results and key words;
- Reading selected websites and evaluating information on these websites accordingly;
- Refining key words and beginning re-searching if necessary.
Afflerbach and Cho (2009) proposed a set of hypertext searching and reading strategies for constructing hypertexts for educational purposes. These strategies include:

- Using search engines to access and overview possible target information;
- Narrowing down the range of possible information according to purposes of reading;
- Judging the usefulness of the information before accessing it;
- Exploring selected information in order to set up a dynamic plan to achieve reading goals;
- Predicting utility of hyperlinks involved in chosen websites;
- Making inferences between links and main texts of websites;
- Deciding reading sequences based on either coherence or interests;
- Revising keywords and exploring new potential reading paths.

Afflerbach and Cho’s (2009) suggestions are similar to Zhang and Duke’s (2008) conclusions. They both highlight the importance of identifying keywords and choosing relevant websites from results according to hypertext reading goals. In particular, they both emphasise that it is essential to refine keywords and expanding hypertext reading paths. Nevertheless, Afflerbach and Cho (2009) also maintain the importance of making inferences between main texts and links, as well as establishing mental representations based on either coherence or interests. These two particular strategies would lead students to achieve hypertext comprehension.

Teaching students, in particular young students, to search online appropriately has become critical in the era of comprehending online learning materials. Sutherland-Smith (2002a) suggested a number of techniques to teach online searching strategies. Firstly, it is vital for students to know that they need to decide and refine their keywords constantly in order to collect the information they want. Sutherland-Smith (2002) argued that explicit instructions on how to define
keywords should be given to students. Secondly, students need to be given clear search guidelines in order to avoid disorientation. Search guideline should include purposes of searching and reading online, and an estimation of the number of searches could give students a brief overview of their searching tasks. Thirdly, teachers should encourage students to form a broad picture of selected search topics to reach more possible information online. Fourthly, teachers could provide short-cut lists to sites or search engines. This would help those who possess poor computer skills. Fifthly, when dealing with students who do not have high levels of computer skills, it is essential to limit the number of links while designing searching tasks. A large number of links could create the feeling of disorientation and overwhelming (Sutherland-Smith 2002).

3.3 Levels of reading comprehension

Smith (1969) remarks that there are four levels of reading comprehension: the literal level, the inferential level, the critical level and the creative level. The literal level of comprehension is the shallowest level of comprehension, whereas the creative level of comprehension is the deepest one.

3.3.1 The literal level of comprehension

Literal comprehension describes readers’ mental representations that gather direct literal meaning of words, ideas and/or sentences in a certain context. At this level, readers simply recall from their memory what a text says. In other words, readers are able to grasp the meaning of sentences explicitly stated in a text. Bridging inferences take place at the literal level of comprehension (King 2007). Thus, Smith (1969) argues that literal comprehension requires minimum thinking skills in order to understand the text in depth.

3.3.2 The inferential level of comprehension

Inferential comprehension refers to readers going beyond what is written in a text
and drawing conclusions. At this stage, readers are able to link information and knowledge presented in different sections in the text. Thus, meaning that is not explicitly expressed in the text can be extracted at this level. In other words, inferential comprehension presents a deeper level of comprehension than literal comprehension. Smith (1969) suggests that in order to achieve inferential comprehension, readers need to be able to supply additional information by: reading between lines; reasoning cause and effect; anticipating endings; making comparisons and discovering relationships. Predictive inferences are considered to help readers achieve the inferential level of comprehension (King 2007).

3.3.3 The critical level of comprehension
Critical comprehension refers to readers’ forming mental representations by applying their prior knowledge while reading. Both literal and inferential comprehension are part of critical comprehension. Also, readers should be able to judge and appraise what they have read based on their prior knowledge, as well as express their own opinions. Thus, readers’ prior knowledge plays an essential role if they want to achieve this level of comprehension. It is suggested that elaborative inferences are essential for readers to achieve the critical level of comprehension (King 2007).

3.3.4 The creative level of comprehension
Creative comprehension describes the fact that readers are able to generate new ideas, solve problems in real life and obtain additional insights after reading. It is considered to be the highest level of reading comprehension, since it calls for activities that are beyond the direct implications of a text.

Section 3.3 has analysed and discussed different levels of comprehension. Answering literal, inferential and critical questions was a task that was employed in the present study to assess students’ reading comprehension. In order to discuss reading comprehension in detail, it is necessary to understand how
influential theories explain reading comprehension from the cognitive psychology perspective. Section 3.4 reviews and discusses two influential theoretical frameworks, including the Construction-Integration Model and the Schema Theory.

3.4 Theoretical Frameworks

Researchers have established a number of theoretical frameworks explaining reading comprehension processes. The Construction-Integration (CI) Model and the Schema Theory are two influential theories employed by numerous researchers in their studies. In addition, the Hypertext Reading/Comprehension Model has been developed based on the CI model to illustrate the process of comprehending hypertexts (Protopsaltis & Bouki 2005). In this section, the CI model, the Hypertext Reading/Comprehension Model and the Schema Theory are reviewed and discussed. Their applications in the hypertext environment are also included.

3.4.1 Construction-Integration Model

The Construction-Integration (CI) Model was developed by Kintsch and van Dijk (Kintsch 1998, 1988; van Dijk & Kintsch 1983). This model explains reading comprehension from the human cognition perspective. In general, the CI model argues that reading comprehension is a mental process in which readers construct mental representations and integrate them with readers’ prior knowledge. van Dijk and Kintsch (van Dijk & Kintsch 1983) argue that text coherence and readers’ prior knowledge influence the formulation of readers’ mental representations.

Text coherence describes the degree to which readers are able to understand relationships of ideas presented in a text. It relies on how explicitly these relationships are displayed in the text (McNamara & Kintsch 1996). Prior
knowledge refers to a reader’s knowledge base of certain topics or themes. Some researchers prefer using the term ‘domain knowledge’ to describe prior knowledge (Perfetti, Landi & Oakhill 2007).

Researchers and scholars have focused on investigating the relationship between text coherence and the level of readers’ prior knowledge. McNamara and her research colleges (McNamara, Kintsch, Songer & Kintsch 1996) conducted a study to investigate how text coherence influences readers’ comprehension performance. This study concludes that high coherent texts would enhance comprehension results of readers with a low-level of prior knowledge. On the other hand, readers who possess a high-level of prior knowledge would benefit from low coherent texts. Moreover, this phenomenon has been defined as the reverse coherence effect (O’Reilly & McNamara 2007).

O’Reilly & McNamara (2007) carried out a similar study with a new variable: readers’ reading skills. They found that only less skilled comprehenders with a high-level of prior knowledge would display a reverse cohesion effect. In fact, skilled readers with a high-level of prior knowledge would still benefit from highly cohesive texts. Moreover, readers’ comprehension skills will compensate for their low-level of prior knowledge.

The CI model suggests that text coherence, and readers’ prior knowledge affect mental representations formed by readers (Kintsch 1998, 1988; van Dijk & Kintsch 1983). Kintsch (1988) proposes multiple levels of mental representations including the surface code, the text-base and the situational model. These three levels of representations are elaborated next.

3.4.1.1 The surface code representation
At this level, readers understand the meanings of words and the syntax of sentences (Kintsch 1988). The surface code level of representation is similar to
the decoding component in the simple view of reading comprehension (Hoover & Gough 1990). At this level, reading comprehension does not occur, since no bridging inferential activities take place.

3.4.1.2 The text-base representation
In order to establish the text-base representation, readers develop inferential activities (such as bridging inferences and predictive inferences) to generate a basic understanding of texts. Relying on their text-base level representations, readers can recall and summarise what they read. Furthermore, readers also try to connect information expressed in different sections of a text to each other, at the text-base level. At this stage, readers normally achieve shallow comprehension. In comparison with levels of comprehension suggested by Smith (1969), text-base representations include both the literal level and the inferential level of comprehension. However, van Dijk and Kintsch (1983, p. 51) state that no inferences are made while establishing text-base representations, since “the text-base is representation of the text as it is”. All types of inferences, including bridging inferences, predictive inferences and elaborative inferences, are made while readers integrate prior knowledge with new information.

While reading hypertexts, link selection strategies have effects on the formulation of text-base representations. Selecting links in different sequences would lead to diversified reading orders. Consequently, readers make inferences differently, which can result in the different establishment of text-base representations (Protopsaltis 2008).

3.4.1.3 The situational model
The situational model requires readers to critically connect the new knowledge/information they obtain from reading, to their prior knowledge. Furthermore, inferential activities (such as elaborative inferences and predictive inferences) are carried out in order to integrate new knowledge into readers’
background knowledge. As a result of integration, readers re-organise or re-structure their knowledge in a particular domain as a whole. The critical level of comprehension takes place when the situational model is established.

In the context of hypertext reading, it is argued that readers with low prior knowledge would benefit from coherence link selection strategies when establishing situational models (Salmeron et al. 2005). It is suggested that, in light of coherence, navigating can compensate for low-knowledge readers’ gaps in prior knowledge. On the other hand, readers with high-knowledge can build situational models when employing interest-link selection strategies. Their prior knowledge enables smooth node transitions to occur in the hypertext reading context (Salmeron et al. 2005).

Protopsaltis and Bouki (2005) developed a hypertext reading comprehension model based on the CI model. It includes link selection strategies, reading comprehension strategies, as well as the use of metacognition. This new model will be discussed in the following section.

3.4.2 The Hypertext Reading/Comprehension Model
Protopsaltis and Bouki (2005) introduced the Hypertext Reading/Comprehension Model based on the Construction-Integration model. There are eleven components in this model: forming a goal or task, scanning categories of information, reading these categories, building the text-base representations, building the situation model representations, using appropriate strategies, monitoring, following appropriate paths, repeating as many times as necessary, accomplishing goals and recycling if comprehension does not occur. These components are explained below.

- Formatting of a goal or task. Reading comprehension goals direct readers to complete reading tasks. In hypertext reading, goals also determine link
selections and reading sequences. It is argued that reading goals can either be given to, or formed by readers, depending on different purposes for reading. In addition, reading goals distinguish relevant or irrelevant prior knowledge.

- Scanning categories of information. At this stage readers should quickly scan information presented on the homepage, and roughly decide relevant and irrelevant information according to their reading goals. Further, readers need to quickly determine their starting point of reading in order to complete their comprehension tasks.

- Reading categories of information. Readers start reading at this point. They may select links and determine their reading sequences based on their goals. They try to extract information from hypertext nodes that are relevant to their reading goals. Readers start to establish surface code mental representation at this stage.

- Building the text-base representations. Readers begin to make basic inferences and grasp the semantic meaning of sentences, paragraphs and/or nodes. This concept was adapted from Kintsch and van Dijk’s (1983) CI model.

- Building the situational model. Readers should be able to establish a network of main ideas from texts at this point. They try to link the new information they have got from reading to their prior knowledge. Readers integrate “newly extracted information with previously extracted information, background information and information about the world”, at this stage (Protopsaltis & Bouki 2005, p. 161).

- Using appropriate strategies. Readers choose what to read and what to skim at this point. Also, they may choose to click on a number of links and ignore others. Strategies emphasised in this model are link selection
strategies. Neither cognitive nor metacognitive strategies are taken into much consideration in this particular model.

- Monitoring reading comprehension. This includes, assessments of understanding of information readers have read, and/or assessment of link selections. At this point, readers apply their metacognition to control and monitor their comprehension processes.

- Following the appropriate path. Readers should build correct inferences about information that they have, or are about to read, in different hypertext nodes. At this stage link selections play a crucial role, since they decide readers’ reading sequences. Readers need to make proper inferences depending on their selections of hyperlinks.

- Repeating as many times as necessary. In the hypertext reading context, information is displayed in nodes and/or segments linked by hyperlinks. In this case readers need to repeat the above process many times until they build the situation model of what they are required to read.

- Accomplishing of readers’ goals. Readers should check if their goals are met when they finish reading. If their goals are not fulfilled, readers need to adjust their goals or strategies in the next step.

- Recycling if comprehension fails. At this stage readers are advised to review their goals and link selection strategies to achieve reading comprehension.

The model emphasises the importance of two metacognition components, monitoring and reviewing. Additionally, it also highlights the importance of link selection strategies while reading hypertexts. The Hypertext Reading/Comprehension Model argues that while scanning information, readers activate their schema and select relevant prior knowledge. The next section will discuss the Schema Theory of reading comprehension.
3.4.3 The Schema Theory

The Schema Theory argues that reading comprehension is to allocate new information obtained from reading into various knowledge clusters in readers’ memory (Anderson & Pearson 1984). A schema refers to a knowledge structure of a particular topic. In fact, the notion of schema has been widely used in the field of cognitive psychology. According to the Schema Theory, readers activate their schemata while reading, and place new knowledge into various groups. Thus, the metaphor ‘mental home’ has been used to describe the function of a schema (Anderson & Pearson 1984).

How knowledge is represented in the mind is a core issue in the Schema Theory (Nassaji 2007). From the schema-theoretic perspective there are five processes to underlie mental knowledge representations, including selection, abstraction, interpretation, integration and re-construction. It is argued that only the information related to activated schemata will be selected and decoded while reading. While abstracting information, only its semantic components are encoded in memory. The interpretation process connects new information to activated schemata. New information is stored into organised and coherent knowledge structures while integration takes place. Finally, readers re-construct activated schemata as new information is absorbed (Nassaji 2007).

Inference making is another key issue in the Schema Theory. Successful comprehension lies in inferences at different levels of comprehension (Nassaji 2007). Anderson and Pearson (1984) suggest that readers need to select useful schemata in order to make meaningful inferences. In this respect, readers’ prior knowledge of a given topic plays an essential role. Amongst all chosen useful schemata, readers should be able to align them to different sections of a text.

Both the CI model and the Schema theory argue that reading comprehension is related to mental representations of knowledge. Furthermore, they maintain that
readers link the new knowledge into their existing knowledge of a given topic. However, the Schema Theory emphasises the process of knowledge reconstruction. In addition, the CI model argues that inferences are made only when situational models are established. On the other hand, the Schema Theory maintains that inferences are made across all levels of comprehension.

It is believed that inference making and prior knowledge have impacts on readers’ reading comprehension performance (Anderson & Pearson 1984; McNamara et al. 1996). Apart from these two factors, there are a number of other issues that may lead to different reading comprehension performance. The next section will elaborate these factors in detail and discuss how they influence hypertext reading comprehension in particular.

3.5 Factors that influence hypertext reading comprehension

Previous research studies revealed several key factors that influence hypertext reading comprehension. These factors fall into two categories and include personal factors and design factors. The major personal factors include:

- Purposes/motivation for reading;
- Readers’ prior knowledge;
- Readers’ working memory;
- Readers’ learning styles.

The major design factors include:

- Interface design;
- Hypertext structures.
3.5.1 Personal factors that influence hypertext reading comprehension

Personal factors consist of readers’ personal traits (working memory and learning styles), personal objectives (purposes and motivation for reading), and knowledge base and skill sets (prior knowledge and system knowledge). These factors are elaborated below.

3.5.1.1 Readers’ purposes and motivation for reading

In the last decade of the Twentieth century, research studies on hypertext reading comprehension remark that diversified purposes and motivations for reading can result in different comprehension performance (Barab, Bowdish & Lawless 1997; Slatin 1990). Slatin (1990) analyses three types of hypertext readers (browsers, users, and co-authors), based on their purposes and motivations for reading. The three types of readers have been elaborated in chapter 2, section 2.2.4.

In 1997 Barab et al., conducted a study to test readers’ hypertext reading behaviour under the influence of different purposes and motivations. They suggest four different types of readers: model users, disenchanted volunteers, feature explorers, and cyber cartographers. Amongst all types of readers cyber cartographers are the goal-directed and process-focused readers, who thus achieve best comprehension performance. They are curious while reading hypertexts and able to achieve deep levels of comprehension in comparison to other readers. Model users are normally performance-oriented. They tend to focus on completing learning tasks, but read materials at shallow levels. Feature explorers are attracted by special features of hypertexts, such as videos, and not motivated to complete learning tasks. Disenchanted volunteers are not motivated by any special features of hypertexts or information online, which leads them to having the poorest scores amongst all groups in completing learning tasks (Barab et al. 1997).
3.5.1.2 Readers’ prior knowledge

Research studies on conventional print-text comprehension have concluded that prior knowledge has a substantial influence on readers’ comprehension performance and learning outcome (O'Reilly & McNamara 2007; Shapiro 2004). Prior knowledge refers to what a person already knows about the world (Waniek & Schafer 2009). Prior knowledge also refers to one’s existing knowledge in a particular domain, such as engineering, mathematics and chemistry. In the hypertext context, one’s prior knowledge may also refer to one’s level of knowledge in computers and relevant systems (Mitchell, Chen & Macredie 2005). Extensive research literature has been established to detect the influence of readers’ individual prior domain knowledge on their hypertext reading performance.

In the hypertext world, reading is associated with navigation. Navigation describes hypertext readers’ activities and decisions about hyperlink selections, and making individual pathways throughout a hypertext system (McNabb 2005 - 2006). McDonald and Stevenson (1998) carried out a study to investigate the link between students’ prior knowledge and navigation performance. Readers’ navigation performance was measured by the number of links they opened under a certain time limitation, and the accuracy with which they could link questions to specific nodes. They concluded that students who possess high prior knowledge perform significantly better than those who lack prior knowledge of the same domain (McDonald & Stevenson 1998). Although their study did not specifically test the correlation between hypertext comprehension and prior knowledge, their conclusion still addresses the importance of prior knowledge for learning in the hypertext world.

Calisir and Gurel (2003) compare students’ hypertext comprehension between those who are knowledgeable and those who are non-knowledgeable in a particular domain. The result asserts that knowledgeable students’
comprehension performance surpasses those who are non-knowledgeable. This result has been confirmed by studies conducted by Muller-Kalthoff and Moller (2006), and Amadieu, Tricot, and Marine (2009).

Prior knowledge determines how readers select reading sequences in the hypertext world; and reading sequences influence comprehension performance, since it affects the linkage between ideas (Salmeron et al. 2005; Salmeron et al. 2006a, b). It has been remarked that different link selection strategies are used by readers with different levels of prior knowledge. Readers who have a low level of prior knowledge tend to choose nodes related to previous ones in order to achieve cohesive comprehension. On the other hand, readers with a high level of prior knowledge prefer the most interesting nodes, in their opinion, to less interesting ones, since their sufficient prior knowledge recovers contextual gaps in each node (Salmeron et al. 2006a, b). Salmeron and his research colleagues also admitted that readers had very restricted paths through hypertexts used in their experiments, which might not happen in the real hypertext environment. Nevertheless, the restricted paths have allowed researchers to closely examine readers’ link selection strategies and their influence on hypertext comprehension.

Apart from domain knowledge, readers’ system knowledge is considered to be part of readers’ prior knowledge. System knowledge represents readers’ knowledge of computer systems used, including general computer experience, and experience using hypertext and the Internet (Mitchell et al. 2005). Mitchell et al. (2005) suggest that readers who are interested in the Web are more able to cope with the non-linear learning environment. Moreover, Waniek and Schafer (2009) reveal that students with high system knowledge are good at online information searching, whereas students who have no idea of the hypermedia system, but have prior domain knowledge of topics used in the study, take more time reading nodes but less time navigating. Given the rapid advance of ICT, computers and relevant Internet technology are getting cheaper; thus, the
number of students who have access to computers and the Web at home is increasing. In this respect, students become sophisticated with using computers and the Internet, as they have become part of their study and daily life. Therefore, some researchers prefer to address students who were born after 1990 as the Net Generation (Jones, Ramanau, Cross & Healing 2010).

3.5.1.3 Readers’ working memory

‘Working memory’ was used to replace the term ‘short-term memory’ in the 1970s by Baddeley and Hitch (1974). It describes the mental system that is necessary for concurrent information storage, transition and processing. Working memory plays a vital role when human beings are reading and listening (Baddeley 1992; Baddeley & Hitch 1974). Just and Carpenter (1992) apply functions of working memory specifically into language comprehension. In their theory, working memory capacity determines language comprehension. Working memory capacity can be described as the maximum amount of information that working memory can store and/or process (Just & Carpenter 1992). Working memory capacity is limited. Once working memory reaches its limit, memory cannot maintain any more new information. Moreover, Just and Carpenter (1992) argue that there exist some differences in individual working memory capacity, which can lead to different individual reading outcomes.

In his influential article, Conklin (1987) suggests that reading hypertexts may create cognitive overload for readers. This happens, as readers are required to make selection decisions amongst a large number of hyperlinks, and remain aware of their positions in the hypertext world. Wenger and Payne (1996) argue that reading hypertexts increases demands on readers’ working memory, considering they might experience cognitive overload.

Lee and Tedder (2003) conducted a study to test the effects of readers’ working memory in the hypertext reading environment. It has been concluded that
readers with high working memory have higher scores in terms of recalling hypertext nodes, than those who have low memory. However, this study did not test how individual differences in working memory influence hypertext reading comprehension.

Although not originally developed in the hypertext-learning context, Cognitive Load Theory still attracts researchers’ attention, since it looks into how working memory capacity can affect learning with hypertexts. ‘Cognitive load’ refers to “any demands on working memory storage and processing of information” (Schnotz & Kurschner 2007, p. 471). Two components are included in the cognitive load: intrinsic load and extraneous load. Intrinsic load is determined by the nature of learning tasks; extraneous load is caused by how information to be learnt is presented. The sum of intrinsic load and extraneous load is one’s working memory capacity. Under the limitation of one’s working memory, if learning tasks are easy, learning outcomes are not harmed, even if instructional materials are poorly organised. Moreover, difficult learning tasks presented in a well-organised format do not hinder the final learning outcome. However, if learning tasks are difficult, then poorly presented instructional materials do affect learning outcomes negatively, since the sum of intrinsic load and extraneous load exceeds one’s working memory. Thus, it is recommended that teachers and other experts in the area of education reduce extraneous load in instructional design as much as possible (Schnotz & Kurschner 2007).

The notion of germane load was introduced in the mid-1990s. Germane load increases learners’ curiosity and willingness to learn. Although germane load requires extra working memory capacity, it benefits overall learning results, since it assists students in storing new knowledge into their long-term memory, and linking new knowledge to their prior knowledge.

The traditional assumption was that hypertext reading puts a heavy demand on
readers’ working memory, since navigation through hypertexts occupies cognitive resources in terms of decision-making. Readers also need to keep themselves aware of their positions in hypertext systems during navigation. Zumbach (2006) did a research study to test the relationship between the level of text complexity and the types of text (traditional print-based texts and hypertexts). The result reveals that students who read hypertexts with a high level of complexity outperform those who read traditional texts with the same level of complexity. This might be because with the fixed level of complexity, hypertexts encourage germane load by presenting non-linearly organised nodes. This result may support early scholars’ arguments that hypertexts are more appropriate for educational purposes than traditional texts, since people also obtain and process information in a non-linear fashion. Nevertheless, it should be noted that Zumbach’s (2006) study does not take into account students’ levels of prior knowledge as a variable. According to Salmeron et al. (2005), although the nonlinearity of hypertexts appears similar to the way humans process information, students who possess higher levels of prior knowledge in a given topic, still outperform students whose prior knowledge is lower.

3.5.1.4 Readers’ learning styles

The way people mentally process information or stimuli from the external world varies (Guisande, Paramo, Tinajero & Almeida 2007). Individual preferences in approaches to organising information are defined as learning styles (Chen & Macredie 2002; Salmeron et al. 2010). Scholars have contributed various theory frameworks of learning styles. The models which are frequently referred to in research studies on hypertext learning include the Field Dependence-Independence (FDI) theory (Chen & Macredie 2002; Guisande et al. 2007), Felder and Silverman’s five dimension theory (Hourigan & Murray 2010; McLoughlin & Lee 2007; Trentin 2009) and Kolb’s learning style theory (Protopsaltis 2008). As hypertexts are increasingly employed in the education spectrum, researchers are tending to explore the influence of learning styles on
comprehending hypertexts.

Field Dependence-Independence (FDI) theory

Wiktin’s Field Dependence-Independence model describes two opposing dimensions of representing information. One dimension is referred to as field-dependence (FD). Individuals who prefer this style tend to grasp and recall information from social interactions, such as conversations and relationships. In this respect, they normally prefer working in a team environment. In addition, FD learners have difficulties in applying their prior knowledge while processing new information. They have difficulties in separating and restructuring information from its context. Moreover, FD learners usually accept ideas as they are presented, since they are not good at reasoning. In general, FD learners rely heavily on the surrounding environment to obtain knowledge (Chen & Macredie 2002; Ruth & Houghton 2009).

Another dimension in FDI theory is known as field-independence (FI). Learners who prefer this style do not rely on social interactions as a major channel to acquire information. FI learners prefer working by themselves. FI learners are good at linking new information to their prior knowledge. Furthermore, they are able to separate information from its surrounding context. In other words, they can abstract information or stimuli from its background field. They tend to analyse ideas before accepting them, as they are able to demonstrate good reasoning skills. Therefore, external environment and/or background fields are not the determinant issue for them acquiring information (Chen & Macredie 2002; Ruth & Houghton 2009).

Lin and Davidson-Shivers (1996) conducted a research study to investigate the influence of hypertext structures and learning styles on students’ performance in the hypertext environment. They randomly assigned participants into different types of hypertext structure conditions. Participants were given different degrees
of navigation freedom under different linking conditions. Participants were given a test to explore their learning styles (FD or FI) before they began reading hypertexts. Also, they were asked to complete a questionnaire after being required to read hypertexts. The questionnaire data showed that FD learners tend to prefer less structured hypertexts, while FI learners seemed to prefer more structured hypertexts. Overall FI learners outperformed FD learners in every hypertext linking structure. Moreover, FI learners were more active or participative than FD learners in the hypertext reading context. This research did not put specific attention on comprehending hypertexts, but concentrated on exploring their navigational behaviour online (Lin & Davidson-Shivers 1996). Thus, findings in this research can be employed while designing hypertexts for educational and instructional purposes.

Chen and Macredie (2002) developed a hypermedia learning model based on FDI theory and previous research on online learning. They suggest that FD learners tend to prefer guided navigation, while FI learners prefer freedom of navigation while reading online. They also recommend that FD learners be provided with limited learner control while learning in hypermedia systems, while FI learners can be offered a high level of learner control.

Akdemir and Koszalka (2008) conducted research to explore the relationship between online instructional strategies and learning styles, based on the FDI theory framework. It is concluded that as long as instructional strategies match learners’ learning styles (FD or FI learners), there would not be a significant difference in learning outcome amongst learners with different learning styles while learning online.

Chen, Fan and Maredie (2006) conducted a study on students’ learning styles and their learning outcomes in the online learning context. The focus of Chen et al.’s (2006) study was on FI and FD learners’ navigational behaviour. Although FI
and FD learners do not present significant differences in terms of approaching information, they do prefer using different navigational tools while learning in a web-based environment. It is recommended that flexible tools, such as an alphabetical index, are essential for FI learners to learn online effectively. On the other hand, FD learners need to be provided complete pictures of what is to be learnt and informed of their current positions to cater to their needs of learning online (Moos & Azevedo 2008).

Felder-Silverman’s five dimensions model

Felder and Silverman (Felder 1993) developed a learning style model based on five categories of how learners acquire information while learning (Hourigan & Murray 2010; McLoughlin & Lee 2007; Trentin 2009). These categories include sensory vs. intuitive learners, visual vs. verbal learners, inductive vs. deductive learners, active vs. reflective learners, and sequential and global learners.

Sensory learners prefer to receive information from concrete and practical activities, and are oriented towards facts and procedures. Intuitive learners normally obtain information from conceptual and innovative activities, and are oriented towards theories and meanings.

Visual learners tend to receive information from pictures, diagrams or graphics during the learning process. Verbal learners tend to learn from written and spoken words, and mathematical formula.

Inductive learners are those who prefer presentations that proceed from the specific to the general. Deductive learners are those who prefer materials where information is organised from the general to the specific one.
Active learners obtain information from practicing various activities and working out new ideas, and prefer working in teams. Reflective learners think carefully before practicing new activities or ideas, and prefer working alone.

Sequential learners process new information step by step in a linear fashion. Global learners normally think globally and systematically, and learn in large leaps.

Dunser and Jirasko (2005) employed the category of sequential vs. global learning style to examine the relationship between learning styles and hypertext learning. The results revealed that sequential learners would benefit from hypertext systems with structural aids attached. On the other hand, global learners were not influenced by the additional structural aids. Given the non-linear and non-sequential nature of hypertext, they also suggest that additional linear aids in hypertext systems should not degrade global learners’ learning achievement, but increase sequential learners’ learning outcome.

Graf, Liu, Kinshuk, Chen and Yang (2009) conducted a program to investigate how sequential and global learners approach contents and learning objects in an online learning environment. Their results revealed that sequential learners prefer travelling from one learning object to another, while global learners travel from one learning outline to another. They also made comments on previous studies on learning styles and navigation patterns. They comment that previous studies emphasise identifying how long learners spend on navigation, and what types of navigational tools and/or aids they prefer. However, previous researchers on this topic have not paid enough attention to discussing the contents or learning objects that learners with different learning styles prefer (Azevedo & Witherspoon 2009). Although Graf et al.’s (2009) study has expanded a new paradigm, they did not compare learning outcomes of students with different learning styles.
Kolb’s Four Learning Styles

Kolb (1984) introduced four different learning styles based on previous research findings on learning styles. These four styles include convergent orientation, divergent orientation, assimilation orientation and accommodation orientation. Convergent learners learn through conceptualisation and active experimentation. In this sense, convergent learners are good at problem solving, decision-making and the practical application of ideas. By contrast, divergent learners stress concrete experience and reflective observation while learning. They have strong imaginative capabilities, and thus are able to generate alternative ideas in brainstorming activities. Assimilation learners are similar to convergent learners, who are good at abstract conceptualisation and reflective observation. Moreover, they have the ability to reason and create theoretical models. Accommodation learners, on the other hand, prefer concrete experience and active experimentation. In this respect, they are similar to divergent learners. They learn new information, carry out plans and perform tasks according to the different situations they are in (Kolb 1984).

Two recent research studies related to Kolb’s learning style model for learning from hypertexts (Tsai 2009; Xie et al. 2008), tested participants learning orientation under Kolb’s framework in their pre-tests. Students were asked to complete tasks after reading hypertext materials in their post-tests. These results reveal that students’ hypertext learning outcomes have no significant difference amongst students who prefer different learning styles. It should be noted that in these two studies students were allowed to navigate through referentially structured hypertexts (i.e. the real Internet environment) with various pictures, audio and video clips. In this respect, students had the freedom to choose different paths through hypertext systems, so that they were able to obtain
information in their preferred approaches.

In general, it seems there is not much conclusive research on the effects of learning styles on hypertext comprehension outcomes. It might be due to the flexibility in the hypertext system design; thus, learners might have various degrees of freedom while reading online. More research is needed to confirm the influence of learning styles on reading and learning in the hypertext world.

3.5.2 System design factors that influence hypertext reading comprehension
There are two system design factors that have an impact on hypertext reading comprehension, known as interface design and hypertext structures. This section will elaborate each of the above factors.

3.5.2.1 Interface design
While reading and interacting with hypertexts, readers obtain information from computer screens instead of paper while reading hypertexts. Thus, the way of displaying the information contributes to hypertext comprehension performance. Previous research revealed that the use of unusual fonts, and inappropriate combinations of text colour and background colour can lead to reading difficulties for hypertext readers. This is particularly the case when readers are reading in languages other than their first languages (Tindale 2005a; Walz 2001). Accessibility of the Internet and the quality of computer hardware and software also influences readers’ online reading results. For example, it may take longer to load webpages if students use dial-up Internet rather than broadband. In this sense, students who use the dial-up Internet get online information slower than those who use the broadband. Also, if certain webpages or websites are removed or deleted from the Internet, readers would be unable to get access to them again (Walz 2001).

Another issue related to interface design is identifying the amount of control users
are allowed to have. Learner control refers to enabling learners to make decisions on the pace, paths, flow and objects of their learning (Jones et al. 2010). Oliver and Herrington (1995) suggest that the amount of control students are given have impacts on their learning outcome in the hypermedia context. They argue that while reading hypertexts with linear structures, readers have some limited control over the sequences and content they read. Thus, linearly structured hypertext systems have a full program control (Martin 2008). If they read hierarchically and referentially structured hypertexts, students are allowed to have more control over what they read, and the sequence of reading. However, increased learner control also leads to increased cognitive load (Oliver & Herrington 1995). Thus, disorientation may happen when learners’ control is increased.

In order to reduce or avoid disorientation caused by increased learners’ control, researchers have started to add graphic overviews to their hypertext interface design. A graphic overview is a type of navigational tool that contains linking structures in a hypertext system. In this sense, learners are able to visualise how nodes are connected. Therefore, they can construct their own navigation paths based on the graphic overview included in the system. Research studies on graphic overviews in the hypertext context suggest that graphic overviews benefit those who have higher prior domain knowledge. However, for those who have medium to lower prior domain knowledge, graphic overviews do not lead to significantly increased performance (Muller-Kalthoff & Moller 2003).

Another research study has been conducted to explore the influence of graphic overviews in hypertext systems on hypertext comprehension (Salmeron, Baccino, Canas, Madrid & Fajardo 2009). Hypertexts used in this study were organised and presented either coherently or incoherently. Researchers presented graphic overviews at the beginning of coherent and incoherent hypertexts, as well as the end of these hypertexts. They argued that graphic overviews did not affect
comprehension if they were presented at the beginning of hypertexts, regardless of how coherent hypertexts are. However, students spent more time on graphic overviews when they read incoherent hypertexts than when they read coherent ones. On the other hand, when graphic overviews were placed at the end of hypertexts, it might hinder comprehension. In particular, this arrangement might disadvantage those who possess poor prior domain knowledge (Salmeron et al. 2009).

3.5.2.2 Hypertext structures

Hypertext structures refer to the organisation and presentation of hypertext nodes and links (Slatin 1990). There are three types of hypertext structures in use known as linear structure, hierarchical structure and referential structure. As discussed in earlier sections of this chapter, linearly structured hypertexts have been widely used for educational and instructional purposes. Linearly structured hypertexts have pre-defined reading sequences and provide limited control to users. On the other hand, hierarchically structured hypertexts and referentially structured hypertexts do not have pre-fixed reading sequences, and provide more freedom of navigation to users. Although readers obtain more control over what they have been reading than reading traditional paper-based texts, disorientation can take place in this sense.

McDonald and Stevenson (1996, 1998) conducted two research studies on investigating the effects of different hypertext structures (i.e. linear structures, hierarchical structures and referential structures) on students’ performance during navigation. Navigation scores were based on the amount of information students were able to recall after reading. Their results reveal that students’ performance is the best amongst all structures when they are reading linearly structured hypertexts. Students' performance is the worst when they read hypertexts with referential structure. Although their research has not focused on hypertext comprehension, their results have implied that linearly structured
hypertexts can lead to higher performance when used for educational purposes.

Waneik and her research colleagues (Waniek, Brunstein, Naumann & Krems 2003) carried out a study to investigate the influence of hypertext structures on comprehending hypertexts. They employed three types of hypertext structures: linearly presented hypertexts with “Back” and “Next” buttons, but no structure overview; linearly presented hypertexts with “Back” and “Next” buttons and a structure overview; hierarchically structured hypertexts with a structure overview, which allows students to navigate from one node to another. Participants were asked to write a short summary of what they have read from computer screens. They recalled neither events nor facts in the order presented in hypertexts. Researchers evaluated contents of these summaries in terms of sequences of events included in hypertexts. The results revealed that students tried to build coherent situation model representations of what they read. Moreover, participants’ situational models did not differ significantly, even though they read hypertexts with different structures. Researchers also measured how students establish text structure representations. The results showed that students who read hierarchically structured hypertexts with a structure overview outperformed those who read linearly structured hypertexts with, and without, a structure overview. Moreover, those who read hypertexts with a linear structure and a structure overview perform better than those who read hypertexts with a linear structure only. Researchers argued that structure overviews allow freedom of navigation while reading online, given that participants’ prior knowledge was at the same level. This implies that this conclusion is consistent with previous ones, which argue that non-linearly structured hypertexts are similar to people’s cognition patterns. Moreover, structure overviews presented the construction of information nodes; thus, students were able to have a clear picture of what was included in hypertexts. It is also suggested by researchers that the provision of text structures in the hypertext world is vital, in order to prevent disorientation (Waniek et al. 2003).
Martin (2008) carried out a study to explore the relationship between hypertext structures and practice, in an online learning environment. Martin (2008) used a hypertext system called “Dreamweaver” to display an online learning program. She recruited 240 undergraduate participants and randomly assigned them into four experimental conditions:

- Program with practice and using linear navigation;
- Program with practice and using non-linear navigation;
- Program without practice and using linear navigation;
- Program without practice and using non-linear navigation.

This study included a pre-test, six learning sessions and a post-test. Participants in the four different conditions received every session simultaneously. Participants who were given practice in learning sessions would read online learning materials and answer multiple-choice questions, whereas those who did not get practice only read online learning materials. The results indicated that participants who received practice with linear navigation obtained the higher scores amongst all experimental groups. Those who navigated in the non-linear condition without practice in learning sessions had the lowest scores. The conclusion of this study reinforced that it is essential to provide opportunities for students to practice what they have learnt in a web-based learning environment. Also, linearly structured online learning materials can result in better learning outcomes (Martin 2008).

In general, both hypertext readers’ personal characteristics, and hypertext system design issues, affect outcomes of hypertext reading comprehension. It becomes essential to take into account these factors in order to design and deliver hypertext reading materials successfully. In order to let students comprehend hypertexts effectively, it is important to teach them to read
hypertexts metacognitively. The next section will discuss the influence of metacognitive strategy instruction on hypertext reading comprehension.

3.6 Metacognitive strategy instruction and hypertext reading comprehension

In the teaching and learning context, metacognition refers to learners controlling their own learning processes. Researchers have related metacognition to reading comprehension for decades. As hypertexts have been increasingly used in the education domain, it has been suggested that metacognition plays an essential role in comprehending online texts (Stadtler & Bromme 2007). Thus, it becomes essential for students to master how to apply their metacognition while reading online (McNamara & Shapiro 2005).

As discussed in an early section of this chapter, metacognition includes two clusters of activities, known as knowledge about cognition and regulation of cognition (Baker and Brown 1984). Winograd and Hare (1988) suggested that three elements were included in knowledge of cognition while linking metacognition to reading comprehension instruction: declarative knowledge, procedural knowledge and conditional knowledge. Declarative knowledge refers to ‘knowing what’. In other words, students have clear pictures of what strategies they are going to learn. Procedural knowledge refers to students knowing how to master and deal with these strategies. Conditional knowledge refers to students’ understanding of the value of learning such new knowledge and applying it appropriately. In terms of regulation of cognition, Baker and Brown (1984) maintained that planning, monitoring, evaluating and reviewing were four key issues that should be included in metacognitive reading-comprehension strategy instructions.

Winograd & Hare (1988) suggested five core elements in metacognitive
reading-comprehension strategy instructions, in order to address knowledge about cognition. They are:

- Explanations of strategies. Teachers should provide clear definitions or descriptions of strategies taught in class.
- Reasons for learning such strategies. Purposes and benefits of strategy instructions should be explained to students in order to attract their attention and concentration.
- Explanations of how to use these strategies. Detailed explanations of strategies are needed, in order to show students logical relationships while using these strategies.
- Examples of strategy applications. Teachers should give explicit examples for applying these strategies while comprehending texts. Instances of inadequate strategy application can also be provided to students.
- Evaluation of strategy application. Students should be clearly taught ways to assess and adjust their application of strategies in order to achieve reading comprehension.

Amongst the above five components, explanations of strategies, and reasons for learning such strategies reflect declarative knowledge. Explanations of how to use these strategies address procedural knowledge. Conditional knowledge is reflected via examples and evaluation of strategy applications (Winograd & Hare 1988).

Wilson (2011) argues that metacognition is at the heart of reading comprehension instruction. In order to teach students to read metacognitively, teachers need to model metacognitive processes, debrief with students, as well as provide opportunities for students to implement self-monitoring and adapting. Wilson (2011) suggests teachers model metacognitive processes via think-alouds in order to demonstrate strategies taught in class. Debriefing of strategies allows
teachers and students to share their experience of strategy application. Self-monitoring and adapting enable students to take control of their reading processes and adjust strategy application whenever necessary. In general, these techniques can assist students to comprehend what they read independently and successfully (Wilson 2011).

The following two sections summarise and discuss the effect of metacognitive strategy instructions on students’ hypertext comprehension performance. Section 3.6.1 includes studies that employed a traditional face-to-face instructional approach, whereas Section 3.6.2 contains studies that used electronic metacognitive strategy training mechanisms.

3.6.1 The influence of metacognitive strategy training and instruction
A research study conducted by Verezub and her colleagues (Verezub et al. 2008; Verezub & Wang 2008) indicates that metacognitive strategy training has enhanced students’ hypertext comprehension performance. Students had a pre-test, in which they read hypertexts with text links, picture links and audio links presented in a linear fashion. Students were given three training sessions on applying metacognitive strategies in the hypertext reading context. Six metacognitive strategies were taught in this research, including:

- Clarifying purposes of reading;
- Activating and applying prior domain knowledge;
- Paying attention to important content;
- Evaluating what has been read;
- Monitoring comprehension processes;
- Reviewing comprehension processes.

The instruction approach of this research followed principles proposed by Duffy (2002). According to Duffy (2002), five steps were used in Verezub and Wang’s
(2008) training phase. They were:

- Explicit description: each strategy was described explicitly;
- Modelling of strategy in action: each strategy was modelled by the instructor by using examples of materials and texts to which it can be applied;
- Collaborative use of strategies: strategies were used in action;
- Guided practice: students had exercises under the instructor’s supervision;
- Independent use of strategies: students were encouraged to use strategies independently.

After three training sessions, students were asked to complete the post-test, in which they also read linearly structured hypertexts with text links, picture links and audio links. Their hypertext comprehension results improved significantly after the training program (Verezub et al. 2008; Verezub & Wang 2008).

One essential component of metacognition is learners’ self-regulation of cognition (Baker & Brown 1984). Oliver and Herrington (1995) emphasise that self-regulation plays a vital role in applying metacognitive strategies while reading hypertexts. Self-regulation refers to learners establishing their own goals, and managing and evaluating learning processes by applying various strategies. It is remarked that self-regulated learners are able to plan and monitor their learning processes, evaluate and review what they have learnt, as well as adjust strategies if they encounter any difficulties (Oliver & Herrington 1995).

Furthermore, Azevedo and his research colleagues conducted a number of studies that focus on linking self-regulation to reading and learning in the hypermedia environment. Their research covered hypermedia instructional design, the role of prior knowledge, motivational issues and scaffolding learners’
learning processes in the hypermedia world. One of their studies concentrates on exploring the effect of self-regulation training on learning with hypermedia (Azevedo & Cromley 2004). Two groups, an experimental one and a control one, took part in the study. Both groups were given a pre-test. The experimental group was given a 30-minute training on utilising various self-regulation strategies including planning, monitoring and evaluating. The control group did not get any training on self-regulation strategies. Both groups had a post-test simultaneously. Students’ performance was measured by allocating marks for answering questions related to what they read online. The result revealed that self-regulation strategy training led to a significant improvement in students’ performance while learning in the hypermedia context.

3.6.2 Metacognitive strategy training mechanisms
In order to provide systematic metacognitive strategy training to students, researchers developed a number of mechanisms to assist students in improving their metacognitive reading skills. In this section, three metacognitive strategy-training mechanisms are summarised and discussed, including Self-Explanation Reading Training (SERT), Interactive Strategy Training for Active Reading and Thinking (iSTART) and 3D-Readers.

3.6.2.1 Self-Explanation Reading Training (SERT) and Interactive Strategy Training for Active Reading and Thinking (iSTART)
Self-Explanation Reading Training (SERT) was introduced and developed by McNamara and her research colleagues. The purpose of this training mechanism is to teach students to explain texts to themselves while reading in light of metacognition (McNamara 2004). Reading strategies taught in SERT include:

- Comprehension monitoring: readers know what they have comprehended versus what they have not;
- Paraphrasing: readers re-phrase what they read in their own words;
Elaboration: readers apply their background knowledge while reading;
Predictions: readers forecast what a text will introduce;
Bridging: inferences are made in order to understand relations between sentences.

McNamara (2004) conducted a study to test the effectiveness of SERT in the context of comprehending hypertexts. Hypertexts used in this study were organised in a linear fashion. An experimental group and a control group were involved in the study. Both groups had the pre-test under the same conditions. However, only the experimental group received SERT in the training phase. The control group was asked to read texts aloud without receiving any training. The training phase included two sessions, each of which lasted for 75-120 minutes. Participants in the experimental group were taught reading comprehension strategies and completed hypertext reading comprehension exercises. In the post-test, both groups were asked to read the same text and answer some comprehension questions. The result indicated that the experimental group outperformed the control group in the post-test. It is argued that SERT has enabled readers with a low level of prior knowledge to use paraphrasing and elaboration to form solid and coherent text-base representations. However, the result also revealed that readers who possessed a high level of prior knowledge were not likely to get benefits from SERT. This might be due to the high level of prior knowledge, which made the training less beneficial (McNamara 2004).

It should be noted that SERT is mainly conducted on a face-to-face basis. The way it is conducted follows the traditional classroom instruction approach. As ICT is broadly employed in the domain of education, computers and relevant software are utilised for reading strategy-training purposes.

A web-based tutoring program called Interactive Strategy Training for Active Reading and Thinking (iSTART) has been introduced (McNamara, O'Reilly,
Boonthum & Levinstein 2007a). iSTART consists of three sections, known as introduction, demonstration and practice. All sections are hosted by animated instructors and provide opportunities for students to interact with these animated instructors.

In the introduction section, students are taught various reading strategies by watching animated instructors. Explicit examples of strategy application are contained in this section. At the end of this section, students must answer a number of review questions by applying strategies they have just learnt. In the demonstration section, further instruction of strategy application is given in conjunction with follow-up questions. The program assesses students’ answers as further instruction is being conducted. The higher their scores are, the less structured the follow-up questions will be, whereas the lower their scores are, the more structured follow-up questions will be. In the practice section, students are asked to read a piece of text and answer relevant comprehension questions. Feedback is given to students as the program progresses (McNamara et al. 2007a).

It has been proved that iSTART enhances students’ hypertext reading comprehension performance (McNamara & Magliano 2009; McNamara et al. 2007a). For those who possess a high level of prior knowledge of a domain, iSTART can improve their comprehension performance at the situational model level. On the other hand, if students have a low level of prior knowledge, iSTART can enhance their literal comprehension at the text-base level.

Magaliano and his research fellows (Magliano, Todaro, Millis, Wiemer-Hastings, Kim & McNamara 2005) compared the effectiveness of live reading comprehension strategy training (SERT) with computerised reading comprehension strategy training (iSTART). They recruited two cohorts of post-secondary students to take part in two independent experiments, one of
which tested the effectiveness of SERT, and the other one iSTART. The results of
the two experiments revealed that both SERT and iSTART improved participants
hypertext comprehension, which is consistent with conclusions made by prior
studies. Researchers (Magaliano et al. 2005) suggest that although
computerised comprehension strategy interventions are viable to enhance
students’ reading comprehension performance, teachers and/or developers of
such interventions should ensure computer-based training interventions work as
well as face-to-face instruction. One possible advantage of computerised
interventions, over traditional face-to-face ones, is that computerised
interventions are able to offer individualised training based on users’ levels of
prior knowledge and reading skills. In contrast, in the conventional face-to-face
instructional context, teachers may not be able to devote enough time to provide
individualised attention to all students.

3.6.2.2 3D-Readers

3D-Readers is an Internet-based application designed for reading
comprehension strategy instruction (Johnson-Glenberg 2007). Strategies
included in 3D-Readers are comprehension monitoring, summarising, visualising,
question answering and question generation. In comparison to strategies used in
SERT and iSTART, 3D-Readers also emphasises the importance of
metacognition in reading (i.e. comprehension monitoring strategies). Furthermore,
3D-Readers focuses on encouraging students to form mental
pictures or images while reading (i.e. the visualising strategy).

Prior to the online instruction, 3D-Readers provides students with a pre-test on
vocabulary; feedback is given after the training is finished. One online text is
divided into six sections. Students will come across associated reading
comprehension strategy prompts. Moreover, students will get chances to create
questions for themselves as they read online. In this case, students’ curiosity is
increased. Also, it can encourage students to make proper inferences while
reading (Johnson-Glenberg 2007).

Students will get a post-test on vocabulary when they finish reading the entire online text. Feedback on both pre- and post-tests is given to students with corrections. After the vocabulary test, students are required to answer six open-ended questions. Answers are scored from 0-6. If students get any score less than 3, they are taken back to the text where they can figure out the answer. If students confirm their submission, they get instant feedback from the system (Johnson-Glenberg 2007).

Johnson-Glenberg (2007) conducted three studies to examine the influence of 3D-Readers on students’ hypertext comprehension performance. Results of these studies have confirmed that 3D-Readers improved students’ online comprehension performance. In addition, it is also concluded that metacognition plays an essential role in the hypertext comprehension context.

Compared with iSTART, 3D-Readers pays substantial attention to vocabulary. Also, it encourages students to reread texts if comprehension does not occur. However, it does not explicitly employ strategies that encourage students to make various inferences. In other words, 3D-Readers does not explicitly examine students’ different levels of mental representations of hypertexts.

3.7 Concluding remarks

As ICT becomes widely used for educational and instructional purposes, the ability to comprehend hypertexts becomes essential for contemporary students. First, this chapter has provided an overview of reading comprehension processes. According to Hoover and Gough’s (1990) simple view of reading, reading comprehension consists of decoding and linguistic comprehension. Reading comprehension only occurs when both decoding and linguistic comprehension
take place. RAND Reading Study Group defines reading comprehension as a process in which readers extract and construct meaning from written texts. Three components are included in reading comprehension processes, known as a reader, a text and comprehension activities. Readers’ personal characteristics, such as their working memory and prior knowledge, lead to different reading comprehension outcomes. The way texts are organised and presented also determines readers’ reading comprehension. In particular, hypertexts, as a new format of text, have imposed a number of special features such as non-linearity and multimedia contents on readers. Comprehension activities should include purposes for reading and some tasks. Further, readers always comprehend what they read based on the sociocultural context they are in. In general, reading comprehension is a process, where readers interpret written languages and form their own understanding.

Secondly, various reading comprehension strategies have been discussed in this chapter. Readers employ different reading comprehension strategies to achieve comprehension. Four types of reading comprehension strategies have been discussed in the present chapter including cognitive strategies, metacognitive strategies, social/affective strategies and link selection strategies. Cognitive strategies are used when readers want to handle new information and generate comprehension. Prior studies have revealed that teaching students cognitive strategies can enhance their hypertext comprehension performance. Metacognitive strategies help readers monitor and control their reading processes and detect comprehension failures. Metacognitive strategies are extracted from the notion “metacognition”. Metacognition refers to mental activities that control what and how people think. In this sense, people need to evaluate and regulate their cognitive processes. Relevant literature has remarked that readers who are able to employ metacognitive strategies can comprehend hypertexts effectively. Applying social/affective strategies allows readers to communicate with peers and exchange opinions. In the hypertext
context, using blogs is a typical example of applying social/affective strategies. While comprehending hypertexts, linking selection strategies enable readers to select various links, and formulate different mental representations of texts. Readers can choose hyperlinks based on text coherence, their prior knowledge and/or links’ default positions on screens. In order to search online information successfully, students need to master searching strategies as well. The core of successful online searching starts from defining keywords, which is followed by evaluating and selecting searching results. If students search online information for knowledge acquisition purposes, they need to combine linking selection strategies with searching strategies.

Thirdly, levels of reading comprehension have been summarised and presented. There are four levels of reading comprehension, known as the literal level, the inferential level, the critical level and the creative level. At the literal level, readers understand the literal meaning of what is expressed in texts. At the inferential level, readers connect information presented in different sections of a text. At the critical level, readers' prior knowledge is applied in order to achieve comprehension. At the creative level, readers are able to form new ideas and solve problems in the real life.

Furthermore, three influential theoretical frameworks of reading comprehension have been reviewed and discussed. They are the Construction-Integration (CI) Model, the Hypertext Reading/Comprehension Model, and the Schema Theory. The CI Model argues that readers form different types of mental representations of what they read in order to achieve comprehension. There are three types of mental representations, known as the surface code, the text-base and the situational model. At the surface code level, readers understand meanings of words and sentences, but comprehension does not happen at this stage. At the text-base level, readers start making inferences and interpret texts. They also link information in different parts of a text to each other. While establishing their
situational models, readers integrate the new information with what they already know.

The Hypertext Reading/Comprehension Model was developed based on the CI model. It illustrates the process of comprehending a hypertext in eleven steps. In general, this model argues that hypertext readers need to have clear purposes for reading, select links based on their purposes, build different mental representations of hypertexts, monitor their comprehension processes, and adjust reading strategies if comprehension does not occur.

The Schema Theory argues that reading comprehension is to place new knowledge into different clusters of knowledge in readers’ memory. While reading, readers gradually integrate new information with the old and re-construct their knowledge base of a particular domain.

Also, the present chapter has analysed and discussed factors that impact hypertext reading comprehension. Both personal factors and design factors influence readers’ hypertext comprehension. Personal factors that affect hypertext reading comprehension include readers’ purpose/motivation for reading, readers’ prior knowledge, readers’ working memory and their learning styles. Design factors include interface design and hypertext structures. Research findings of recent studies that are related to these factors have been summarised and discussed in this chapter.

Lastly, the current chapter has presented the importance of teaching students to read metacognitively, and metacognitive strategy training mechanisms. Prior studies have confirmed that teaching students to comprehend hypertexts metacognitively is crucial. Traditionally, metacognitive strategy instructions follow the face-to-face teaching approach. For example, Self-Explanation Reading Training (SERT) is a face-to-face metacognitive strategy training mechanism
developed by McNamara (2004). As ICT becomes more widely used in the domain of education, metacognitive strategy training mechanisms become computer- and web-based. The use of Interactive Strategy Training for Active Reading and Thinking (iSTART), and 3D-Readers, are discussed in the present chapter as well.

Being an English speaking country, Australia is attracting more and more international students to come and continue their education. Thus, reading comprehension, in particular hypertext reading comprehension, is considered to be one of the challenges for international students. In this respect, the following chapter will analyse and discuss what difficulties they have in terms of comprehending texts, especially hypertexts, and how to help them to overcome such difficulties.
Chapter 4

Reading and comprehending hypertexts by students from non-English speaking backgrounds

Since Australia has become a popular study destination, more and more international students choose Australia to continue their education (International Students in Australia 2010). In 2009, more than 630,000 international students from various nationalities came to Australia to study across various educational sectors. Given ICT has been widely employed in all educational sectors in Australia, it becomes challenging for international students who come from non-English speaking backgrounds (NESB) to obtain online information. Therefore, understanding what difficulties NESB students have while reading hypertexts, can help teachers and academic staff to make their curriculum design and instruction cater specifically to NESB students’ needs and expectations. Moreover, teaching NESB students to apply various reading comprehension strategies is crucial to improve their hypertext comprehension performance, and hence improve their learning outcome.

This chapter presents the definition of students from non-English speaking backgrounds. In addition, research studies that focus on NESB students’ hypertext reading comprehension are reviewed and discussed. Furthermore, the influence of various reading comprehension strategies on NESB students’ hypertext comprehension is analysed in this chapter.

4.1 Definition of students from non-English speaking backgrounds (NESB)

A person from a non-English speaking background is defined as someone who was born in a non-English speaking country and migrated to an English speaking
country, or someone who was born in an English speaking country, with one or both parents from a non-English speaking country (Pithers & Lim 1997). In research studies that focus on reading comprehension, terms such as ‘English as a Second Language’ (ESL) or ‘English as a Foreign Language’ (EFL) are used interchangeably to represent NESB students.

Mulligan and Kirkpatrick (2000) quote the definition of NESB students by the Australian Department of Education Training and Youth Affairs (DETYA, cited in Mulligan and Kirkpatrick, p.314): “NESB students are those who are born overseas, speak a language other than English at home, and have been resident in Australia for fewer than 10 years”. In comparison to Pithers and Lim’s (1997) definition, DETYA’s definition of NESB students specifies a time limit for their stay in an English speaking country.

Pithers and Lim’s definition (1997) highlights that NESB students can include two groups of people; the first one consists of those who are from overseas, and the second one includes those who were born in English speaking countries. The present study concentrates on international NESB students who were born in non-English speaking countries, speak a language other than English at home, have been resident in Australia for less than 10 years, and undertake different degrees in Australia.

Comprehending learning materials written in English has been considered as one of the major challenges for international NESB students (Anderson 2003). It is also argued that international students confront even more difficulties while reading hypertext, compared to reading traditional written texts. This may be caused by inappropriate interface design, lack of sufficient vocabulary and a lack of proper prior knowledge on given topics (Tindale 2005, 2005a). Thus, it becomes essential for teachers and academics to understand how NESB students comprehend hypertexts. The following section analyses and discusses
research studies that investigate NESB students’ hypertext reading performance.

4.2 Hypertext comprehension by NESB students

As discussed in Chapter 3, readers’ working memory and hypertext structures are two factors that influence hypertext reading comprehension. When NESB students read hypertexts, these two factors still affect NESB students’ hypertext comprehension performance. Relevant studies are reviewed in section 4.2.1 and 4.2.2.

4.2.1 NESB students’ working memory and hypertext comprehension

A research study, aimed at exploring the influence of NESB students’ working memory on their comprehension of conventional written texts and hypertexts, was undertaken by Fontanini and Tomitch (2009). They recruited 42 NESB participants from two different first language backgrounds, including 21 Brazilians and 21 Chinese. Prior to the reading comprehension test participants’ working memory capacity was tested by the Reading Span Test. This version of the Reading Span Test used in Fontanini and Tomitch’s (2009) study, was adapted by Torres (2003, cited in Fontanini and Tomitch 2009), based on the original version created by Daneman and Carpenter (1980). This adapted version catered to the levels of English of NESB students. Comprehension was measured by three types of instruments including free recall, multiple-choice comprehension questions, and detections of contradictions. Two formats of texts, conventional-written texts and hypertexts, were used in this study. The content of each format of texts was the same and was adapted from articles in the National Geographic magazine. In addition, the topics of texts were carefully selected by researchers, based on participants’ prior knowledge.

Participants were asked to read two formats of texts and accomplish relevant comprehension tasks. Results of the study reveal that the difference between
high-span and low-span participants is insignificant when comprehending traditional print-based texts. However, hypertext comprehension performance of high-span participants differs significantly from low-span participants. Thus, researchers argue that comprehending traditional written texts does not require substantial memory resources, but comprehending hypertexts does. This conclusion is consistent with previous research findings, which maintain that high-span participants comprehend hypertexts more successfully than low-span participants (Fontanini & Tomitch 2009).

As discussed in Chapter 3, apart from readers’ personal factors, system factors such as hypertext design also have effects on students’ comprehension of hypertexts. Researchers have also investigated the influence of system factors on NESB students’ hypertext comprehension. The following section presents studies that explore this particular influence, and discusses NESB students’ perceptions of hypertext design.

4.2.2 Hypertext design and NESB students’ hypertext reading comprehension
It is suggested that necessary annotations can facilitate readers’ comprehension processes (van Dijk & Kintsch 1983). Ercetin (2003) conducted a study to explore the influence of inserting annotations into hypermedia systems, and NESB students’ attitude to annotations. In addition, a comparison between intermediate and advanced learners’ hypermedia comprehension results was carried out.

In Ercetin’s (2003) study, four types of annotations were employed: text annotations, picture annotations, audio annotations and video annotations. These annotations offered participants definitions of some terminologies, and background knowledge of given topics. When participants placed their mouses on highlighted words a relevant annotation would pop up. There were 84 participants in this study including 34 intermediate learners and 50 advanced learners. Participants were asked to read the same hypermedia materials first,
and were required to take notes of what they read. During the comprehension test no access to hypermedia reading materials was allowed. Participants needed to accomplish the test based on their reading notes. The advanced-learner group outperformed the intermediate-learner group in the comprehension test. Moreover, the result revealed that although the amount of time these two groups spent on annotations did not differ significantly, the intermediate group clicked on annotations more frequently than the advanced group.

Twenty participants volunteered to take part in an interview after the reading comprehension test. Both groups considered text and graphic annotations to be helpful to achieve literal comprehension. However, they also preferred video and graphic annotations to obtain background knowledge of given topics. Moreover, participants believed that video and audio annotations were one of the motivations to read hypermedia materials. When asked their attitude to reading hypermedia materials, participants considered hypermedia materials had made their reading enjoyable and comprehensible Ercetin (2003).

Another research study was carried out by Al-Seghayer (2005) to examine NESB students’ attitude towards reading hypertexts. Hypertexts used in this study were well-structured and less-structured. Topics of well-structured and less-structured hypertexts were different. Another difference lies in that there were graphic overviews with well-structured hypertexts. Forty NESB participants took part in this study. They were required to read both types of hypertexts and then participate in an interview session. In the interview session, participants were asked which type of hypertexts they preferred to read. The conclusion of this study revealed that NESB students prefer reading well-structured hypertexts, since NESB participants were aware of their current positions in the hypertext system with the presentation of a graphic overview. Moreover, the provision of the graphic overview also helps to reduce NESB participants cognitive overload.
while reading hypertexts.

Apart from exploring NESB students’ attitude towards hypertexts structured in different ways, Al-Seghayer (2007) also investigated their comprehension performance on hypertexts with various structures. Participants were asked to complete multiple-choice questions, and identify main ideas of what they read. Before reading comprehension commenced, participants were given a 30-minute training session, in which they were taught how to use the given hypertext system. The results indicated that participants’ hypertext comprehension performance, when reading well-structured hypertexts, was significantly greater than their performance when comprehending less-structured hypertexts. Moreover, their answers to multiple-choice questions revealed that well-structured hypertexts had enabled participants to form more coherent mental representations than less-structured hypertexts. Thus, it concluded that well-structured hypertexts should be used for educational and instructional purposes when working with NESB students. Al-Seghayer (2007) suggested that providing necessary training, before NESB students start reading hypertexts, is essential. In addition, it is also recommended that teachers and academics who work with NESB students should teach them explicit hypertext reading strategies such as link selection, summarising and paraphrasing.

Reading comprehension strategies help NESB students increase their hypertext comprehension performance. It is suggested that NESB students have usually received reading comprehension strategy instruction before they come to English speaking countries. However, most of them cannot name strategies they have learnt in English (Lawrence 2007). The following section discusses reading comprehension strategies used by NESB students when they comprehend hypertexts.
4.3 Comprehension strategies used by NESB students

Reading comprehension strategies play an essential role when NESB students comprehend texts (including print-based texts and hypertexts). Fotovatian and Shokrpour (2007) conducted a study to compare the use of reading comprehension strategies (i.e. cognitive strategies, metacognitive strategies and socio/affective strategies), by proficient and deficient NESB students, in the context of comprehending traditional written texts. Fotovatian and Shokrpour (2007) concluded that proficient NESB students apply a large number of various strategies, while deficient ones seldom use reading comprehension strategies when reading. Further, proficient NESB students apply metacognitive strategies more frequently than deficient students; in particular, deficient NESB students are not familiar with metacognitive strategies. Finally, proficient NESB students normally obtain a better understanding of various strategies than deficient ones (Fotovatian and Shokrpour 2007).

Apart from O’Malley and Chamot’s (1990) model, prior studies also examined NESB students’ preferences of reading comprehension strategies under other theoretical frameworks. For instance, global strategies, problem-solving strategies and support strategies (Anderson 1991; Block 1986) have been discussed in the context of NESB students’ comprehension performance.

Global strategies refer to readers’ intentional and planned mental activities to organise and monitor their reading. They include having a clear purpose for reading, previewing the text, examining text structures, making inferences, as well as checking and applying background knowledge.

Local strategies, or problem-solving strategies, refer to actions readers undertake when dealing with the text. These strategies include visualising, guessing the meaning of unknown words, paraphrasing and questioning. Global
and local strategies are similar to the cognitive strategies discussed in O’Malley and Chamot’s (1990) model.

NESB students also use support strategies to comprehend effectively. These strategies involve looking up for words in dictionaries, taking notes, and translating from their mother tongues to the English language.

Anderson (2003) conducted a survey to obtain NESB students’ perceptions of global, local and support strategies while reading hypertexts. The researcher surveyed 247 NESB students, 47% of whom were studying the English language in the US, the remainder of whom were learning English in Costa Rica. Before the survey, all participants were asked to read hypertexts and accomplish relevant activities designed by their teachers during ordinary class time. They were then required to complete the survey, which examined their usage of global, local and support strategies when reading hypertexts.

The results of this survey indicated the top 12 strategies include global and local strategies, eight of which were local strategies and four of which were global strategies. It is noted that seven of the bottom 12 strategies were support strategies. Anderson (2003) highlighted the importance of teaching NESB students to apply various strategies while reading online. He also implied that well planned strategy training should be paid sufficient attention, in order to help NESB students to improve their online reading ability. Although Anderson’s (2003) study highlighted NESB students’ attitudes to various categories of reading comprehension strategies, it did not provide any quantitative data to prove students’ opinions really enhance their hypertext comprehension.

Konishi (2003) carried out a study to explore strategies used by NESB students while reading hypertexts specifically. Six Japanese students took part in this research study. They were asked to browse online articles and answer a number
of questions related to what they had read. During the experiment, think-aloud protocols were employed in order to collect participants’ perception and use of local, global and metacognitive strategies. Participants were interviewed after they had read hypertexts in terms of their use of strategies. The results revealed that the participants used local strategies when they encountered unknown words, while they used global strategies to build the overall coherence of what they had read. When they applied metacognitive strategies they established their goals for reading, monitored their comprehension processes and reviewed their usage of various strategies. The conclusion of this study implied that teaching NESB students to apply metacognitive strategies should play an essential role in daily learning and teaching (Konishi 2003). Although think-aloud protocols and interviews provided insights into NESB students’ perspectives of comprehension strategy use, the number of participants was relatively low (i.e. six participants). It would be hard to argue that conclusions of this study can be widely applied in instructional activities due to the study limitations.

A program aimed at exploring NESB students’ use of online reading strategies was conducted in 2009 in Taiwan (Huang, Chern & Lin 2009). Thirty undergraduate NESB students took part in this program. They had a language test based on TOEFL before the study commenced. Based on this test, participants were split into two groups: one was a proficient group and the other one was a deficient group. The hypertext system designed for this program was called English Reading Online. Its interfaces contained clicks that led participants to use global, local and/or support strategies. Additionally, socio/affective strategies identified by O’Malley and Chamot (1990) were also included in the system design.

Prior to data collection, participants received a two-hour training session to become familiar with English Reading Online. Four two-hour testing sessions were organised. In each session, participants were asked to read one online
article, and then complete a written recall in their mother tongue (Chinese) to express their comprehension. Moreover, the hypertexts’ level of difficulty increased session by session.

The results revealed that NESB participants in this study preferred using support strategies, such as online annotations, to generate their comprehension. Moreover, local strategies were rarely used by these participants. These results contradict Anderson’s (2003) conclusions. This may be due to participants’ levels of the English language, which varied in these two studies. In particular, participants in this study were asked to write summaries in their mother tongue, instead of English. In this respect, applying support strategies can help them obtain better understanding in their mother tongue. Moreover, their background knowledge and proficiency in computers and the Internet can also lead to contradicting conclusions. In addition, Anderson’s (2003) conclusion was based on the qualitative data analysis, whereas Huang et al.’s (2009) conclusion was the result of the quantitative data analysis.

Huang et al.’s (2009) results also indicate that global strategies play essential roles in enhancing NESB students’ hypertext comprehension. They argued that global strategies lead to increased comprehension performance as the program progressed, even though global strategies were not the most frequently used ones. The study also concluded that socio/affective strategies have a positive influence on the deficient group’s comprehension performance, whereas a negative influence is shown on the proficient group’s comprehension performance. Researchers argued that this may be because the deficient group enjoyed interacting with peers while reading, while the proficient group may have preferred taking reading comprehension as an individual activity.

Akyel and Ercetin (2009) conducted a study to investigate NESB students’ hypermedia reading strategies. Ten undergraduate students in a Turkish
university took part in this study. They were advanced English learners according to their language tests. A hypermedia system was designed for this study in particular. Digitised annotations in the form of text, audio, graphics and video were contained in the hypermedia system. Data collection instruments included thinking-aloud protocols, text recall scores, a test on prior knowledge and interviews.

Participants were given a prior knowledge test before the main study. They were also given a training session to familiarise them with the hypermedia system and think-aloud protocols. The text recall test was delivered to students after they finished reading hypermedia materials. After the reading session every participant was interviewed. Comprehension strategies used in this study were cognitive strategies, metacognitive strategies and navigational strategies.

The results revealed that participants with a high level of prior knowledge used more cognitive and metacognitive strategies than those who possessed low prior knowledge. However, low prior knowledge participants tended to use annotations to compensate for missing links in their prior knowledge. This result is consistent with Huang et al.’s (2009) conclusion on participants’ selection of support strategies. In terms of the use of navigational strategies, participants who had a high level of prior knowledge used the follow-the-interest strategy suggested by Salmeron et al. (2005); whereas low prior knowledge participants preferred choosing the cohesion strategy to maintain text coherence. Therefore, researchers argued that NESB students’ link selection patterns were consistent with students from an English speaking background.

Tseng (2010) designed a study to investigate NESB students’ attitude to reading online materials, and factors that may influence their perceptions. Eighty-eight first year students, enrolled in a university in Taiwan, took part in the study. They were asked to complete a questionnaire regarding their attitude to reading
print-based texts and hypertexts. Results of this study indicated that most participants did not prefer reading hypertexts. This was mainly due to getting sore eyes quickly when reading online, as well as feeling disorientated. They still preferred reading conventional print-based texts, since they were able to underline and/or highlight key content, as well as take notes or write summaries on print-based materials.

In particular, Tseng (2010) emphasised three possible factors that may have effects on NESB students’ hypertext comprehension performance, and perceptions of reading online materials. The first factor lies in eyestrain. Participants complained that their vision started blurring and they needed to rub their eyes while reading online. In fact, this conclusion has seldom been found in prior studies. In other words, this conclusion explains hypertext readers’ perceptions from an ergonomic perspective. Secondly, NESB students do not seem to prefer bright background colours on web pages. Although debate does exist in terms of dark-on-light or light-on-dark design of web pages, this conclusion implies that an inappropriate match of background colours and font colours can lead to reading difficulties for hypertext readers, which is consistent with Tindale’s (2005) suggestions. Finally, the length of hypertexts can lead to disorientation. Tseng (2010) argues that unlimited hyperlinks are contained on web pages; thus, it can become difficult for students to backtrack and re-locate information while reading online materials.

On the other hand, participants in Tseng’s (2010) study also admitted the convenience brought by reading online materials. The first one lies in the availability of searching information online, and access to a large volume of information. This suggestion is consistent with conclusions made by previous studies (Slatin 1990). Secondly, participants also commented that reading hypertexts saved paper, which is environmentally friendly.
Although limited, some prior studies have investigated the influence of reading comprehension strategy instructions on NESB students’ reading comprehension performance. The next section discusses a number of studies that contain specific strategy training programs for NESB students.

4.4 Teaching NESB students to read metacognitively

Wichadee (2011) completed a study that examined the effects of metacognitive strategy instruction on NESB students’ reading comprehension improvement in Thailand. Forty, first year undergraduate students, who studied a course called “Fundamental English I”, took part in this study. The experiment lasted for 14 weeks including a pre-test (week 1), 12 metacognitive strategy training sessions, and a post-test (Week 14). Each session lasted for approximately 45 minutes. After the post-test, five participants who obtained the highest marks, and five participants who had the lowest marks, were asked to attend a semi-structured interview to express their perceptions of the instruction and strategy applications.

Reading comprehension strategies taught in Wichadee (2011) involved:

- Highlighting/underlying/circling
- Looking for key words
- Paraphrasing
- Using graphic organisers (diagrams)
- Mental integration/have feelings towards reading texts
- Rote learning of specific information
- Relating information to background knowledge
- Comprehension monitoring
- Problem solving
- Visualising
• Self-questioning
• Re-reading
• Adjusting reading rate

The above strategies were proposed by Wade, Trathen and Schraw (1990). According to O’Malley and Chamot (1990), the strategies instructed in Wichadee’s (2011) study included both cognitive strategies (such as paraphrasing and visualising) and metacognitive strategies (comprehension monitoring and self-questioning). Participants were asked to accomplish reading comprehension exercises of print-based texts in class, and two reading comprehension exercises at home. The results of this study revealed that metacognitive strategy instructions could lead to the improvement of NESB students’ reading comprehension performance. Furthermore, the data collected from the post-test interview indicated that participants who obtained higher scores admitted the effectiveness of the metacognitive strategy instruction, and believed they had become proficient. Meanwhile, those who received low scores maintained a negative attitude towards the instruction, as well as the strategies they learnt. Although hypertext comprehension was not contained in this study, it still confirms the importance of metacognitive strategy instruction for NESB students.

Shen and Liu (2011) designed a website to teach NESB students to apply metacognitive strategies online. The website consisted of four instructional phases, each of which taught students one particular metacognitive strategy. The four strategies taught in this program were planning, monitoring, modifying and evaluating. Online training sessions were delivered to participants on a weekly basis. In each online training session, participants were given the definition of the strategy taught in the present session, followed by a concept map showing the relationship between the new knowledge and their prior knowledge. Multimedia explanations were presented, in order to enhance participants’ understanding of
the strategy. Then learning objectives of the present session were shown on the screen with relevant exercises.

They recruited two groups of participants, including an experimental group and a control group. Only the experimental group received four online training sessions. The control group only received a pre- and a post-test. The results of this study indicated that participants in the experimental group outperformed the control group in terms of applying the planning strategy. There was no significant difference between the two groups in terms of applying monitoring, modifying and evaluating strategies. Participants in the experimental group were able to apply planning and monitoring strategies after they received four online training sessions. Shen and Liu (2011) maintained that these results could result from the insufficiency of the training on comprehension monitoring and self-awareness. Therefore, they suggested that future studies should contain sufficient training on comprehension monitoring and evaluating, in order to make online metacognitive strategy training effective and successful.

4.5 Concluding remarks

In this chapter, definitions of students from non-English speaking backgrounds (NESB) have been analysed and discussed. In general, NESB students refer to those who were born in non-English speaking countries, do not speak English at home, and have been resident in English speaking countries for fewer than 10 years.

This chapter has reviewed the influence of working memory and hypertext design on NESB students’ hypertext comprehension. Prior studies have confirmed that NESB students’ working memory and hypertext design influence their hypertext comprehension. Fontanini and Tomitch’s (2009) study confirmed that NESB students with high-span working memory outperform those who have low-span
working memory. In terms of hypertext design, Ercetin (2003) has concluded that the provision of annotations can assist NESB students in comprehending hypermedia materials. NESB students believe text and graphic annotations can help them achieve literal comprehension. Also, video and audio annotations were considered to be a motivation for NESB students to read hypermedia materials. Al-Seghayer (2005) concluded that well-structured hypertexts should be used for NESB students, since well-structured hypertexts can help NESB students form coherent mental presentations.

Reading comprehension strategies that are frequently used by NESB students have also been summarised and discussed in the chapter. Early studies have discussed O’Malley and Chamot’s (1990) model, and reading comprehension strategies suggested by Anderson (1990) and Block (1986) (i.e. global strategies, local strategies and supportive strategies). Fotovatian and Shokrpour (2007) argue that proficient NESB readers tend to use metacognitive strategies more frequently than deficient ones. Also, proficient NESB students master more strategies, and have a better understanding of strategies, than those who are deficient. According to Anderson (2003), it becomes vital to teach NESB students global and local strategies to comprehend hypertexts. However, in Anderson’s (2003) study, participants did not prefer to use support strategies. On the other hand, Huang et al.’s (2009) research study indicated NESB participants rarely used local strategies, but preferred using global and support strategies. This particular difference may be due to different research methods used in the two studies. In addition, levels of the English language of NESB participants may vary as well.

Konishi (2003) suggests that teaching NESBS students metacognitive reading comprehension strategies can enhance their hypertext comprehension performance. Akyel and Ercetin (2009) indicate that NESB students who possess a high level of prior knowledge use more cognitive and metacognitive strategies
than those who have a low level of prior knowledge. On the other hand, NESB students with low levels of prior knowledge choose annotations to compensate for their lack of relevant knowledge. In general, it is of great importance to teach NESB students various reading comprehension strategies in order to comprehend hypertext effectively.

In terms of NESB students’ perceptions of comprehending online materials, Tseng’s (2010) results suggest that NESB students may not prefer reading hypertexts due to eyestrain. Moreover, inappropriate matching of background colours and font colours may increase reading difficulties. Also, the length of hypertexts creates difficulties for NESB students.

However, relevant literature and prior studies that focus on NESB students’ use of metacognitive strategies while comprehending hypertexts are limited. The effect of reading strategy training, which includes teaching cognitive, metacognitive and hypertext reading strategies, is rarely mentioned. In the present study, the focus is on students who were born in non-English speaking countries and continue their education in English speaking countries. The present study aims at exploring the influence of reading strategy training on NESB students at post-secondary levels in particular. In the following chapter, the overview of the present study will be unfolded. It includes the research method used, experimental instruments, the overall research design, as well as participants.
Chapter 5
Overview of the present study.
The research methodology.

This chapter presents the aims, the research method and hypotheses of the present study. The experimental design, including a reading comprehension strategy training program, experimental instruments, participants and the marking system, is introduced specifically in conjunction with relevant underpinning theories.

5.1 Aims of the current study
As a result of the growing trend to study in English speaking countries, more and more students from non-English speaking backgrounds (NESB) come to English speaking countries to continue their education. Comprehending learning materials in English has become a critical challenge for them, considering language barriers and constraints of their prior knowledge. As hypertexts/hypermedia are widely included in the education spectrum, NESB students may encounter more difficulties when reading hypertexts than when reading conventional written-texts, due to extra demands on their working memory. In this respect, it is essential to teach NESB students to read hypertexts effectively by using appropriate strategies. Moreover, research literature has disclosed that reading strategy training programs enhance students’ reading comprehension performance. However, previous studies on hypertext comprehension have seldom focused attention on students from non-English speaking backgrounds at post-secondary educational levels specifically. The current research project aims to:

1. Investigate the influence of reading strategies (i.e. cognitive strategies,
metacognitive strategies and hypertext reading strategies) on NESB students’ reading comprehension of hypertexts with linear and hierarchical structures;

2. Compare NESB students’ comprehension performance when reading hypertexts with linear and hierarchical structures, before and after reading strategy training.

5.2 Research Method

In general there are two paradigms for carrying out scientific studies: the quantitative research method and the qualitative research method (Jha 2008). The quantitative research method refers to empirical research conducted to collect numerical data. Researchers propose their research questions and hypotheses around existing theoretical frameworks; design and conduct experiments to test hypotheses; and analyse numerical data collected from experiments. The qualitative research method refers to carrying out interviews and observations in natural settings. In this sense, data is collected in non-numerical formats, including pictures and words. The present study employs the quantitative research method, which includes two hypotheses and an experiment to test them. Hypotheses were established based on results and findings of previous research studies. All data collected in this research is in numerical form (Jha 2008).

The quantitative method is used in the present study. There were seven sessions involved in this study including a pre-test, five training sessions and a post-test. Participants were asked to complete a post-test questionnaire. Quantitative data was collected from the pre-test, the post-test and the post-test questionnaire. All seven sessions were delivered to students on a weekly basis. Each session was run approximately for one hour per week. Microsoft Excel and SPSS were used for data analysis purposes. General Linear Model,
independent t-tests, paired sample t-tests, and analysis of means (ANOM) were used, in order to get statistical results of data. General Linear Model was used to detect the interaction between structures of hypertexts (linear and hierarchical), and stages of the experiment (pre-test and post-test). Independent sample t-tests were employed to compare means and standard deviations of each group's comprehension results at the pre-test and post-test stages. Paired sample t-tests were utilised to compare means of the linear and the hierarchical groups' comprehension results in the pre- and the post-tests. Analysis of means (ANOM) was used to present means and standard deviations of the two experimental groups' hypertext comprehension performance at the pre- and the post-test stages. The detail of data analysis is elaborated in Chapter 6.

5.3 Hypotheses

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<th>Hypotheses</th>
<th>Statistical Hypotheses</th>
<th>Tests</th>
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| It is hypothesised that NESB students' hypertext comprehension will improve when reading hypertexts with linear and hierarchical structures after reading strategy training. | **H₀**: It is predicted that reading strategy training will have no influence on NESB students' hypertext comprehension when reading hypertexts with a linear structure. | • Paired sample t-test  
• General linear model  
• Interaction plot  
**H₁**: It is predicted that reading strategy training will have an influence on NESB students' hypertext comprehension when reading hypertexts with a linear structure. |
<table>
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<th><strong>H₀</strong>: It is predicted that reading strategy training will have no influence on NESB students' hypertext comprehension when reading hypertexts with a hierarchical structure.</th>
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<td><strong>Paired sample t-test</strong></td>
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| **H₁**: It is predicted that reading strategy training will have an influence on NESB students' hypertext comprehension when reading hypertexts with a hierarchical structure. |

It is hypothesised that NESB students' reading comprehension of hypertexts with a linear structure will be greater than their reading comprehension of hypertexts with a hierarchical structure, before and after training.

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<th><strong>H₀</strong>: It is predicted that NESB students' reading comprehension of hypertexts with a linear structure will show no difference from their reading comprehension of hypertexts with a hierarchical structure before training.</th>
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<td><strong>Two sample t-test</strong></td>
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| **H₁**: It is predicted that NESB students' reading comprehension of hypertexts with a linear structure will differ from their reading comprehension of hypertexts with a hierarchical structure before training. |
**H₀:** It is predicted that NESB students' reading comprehension of hypertexts with a linear structure will show no difference from their reading comprehension of hypertexts with a hierarchical structure after training.

**H₁:** It is predicted that NESB students' reading comprehension of hypertexts with a linear structure will differ from their reading comprehension of hypertexts with a hierarchical structure after training.

- Two sample t-test
- General linear model
- Interaction plot

1. It is hypothesised that NESB students' hypertext comprehension will improve when reading hypertexts with linear and hierarchical structures after reading strategy training. Previous studies have identified that training programs on comprehension strategies can enhance students' reading comprehension performance (Verezub et al. 2008; Verezub & Wang 2008). However, previous studies on hypertexts comprehension concentrate on students in general. Post-secondary students from non-English speaking backgrounds did not receive much attention as a particular group in previous studies.

2. It is also hypothesised that NESB students' reading comprehension of hypertexts with a linear structure will be greater than their reading comprehension of hypertexts with a hierarchical structure, both before and after training. McDonald and Stevenson (1996) conducted research
to compare students’ navigation performance when reading hypertexts with linear and hierarchical structures. It had been concluded that navigation scores were significantly higher when students were reading linearly structured hypertexts than they were reading hierarchically structured hypertexts. Nevertheless, they did not specifically test and compare students’ comprehension performance when reading hypertexts with these two different structures. In particular, such comparison has merely been done based on readers who are post-secondary students from non-English speaking backgrounds.

5.4 Definitions of key terminologies used in the present study

Key terminologies included in the current study are hypertexts, hypertext reading comprehension, reading comprehension strategies, metacognition, and students from non-English speaking backgrounds. These terminologies have been defined by different researchers and scholars. The present study selected definitions of the above items, based on the relevance of descriptions to the aims of the present study.

Hypertexts: As discussed in Chapter 2, hypertexts are defined as either a functional approach or a semantic approach. Functional definitions highlight the technological structures of hypertexts; whereas semantic definitions emphasise relationships between information presented in different nodes and readers’ choices, while linking nodes together. The present study explores participants’ hypertext comprehension performance; thus, a semantic definition provided by Salmoron et al. (2005, p.171) is selected, which states that hypertexts are “information systems in which the contents are organised in an interrelated network with nodes that are documents and links that are the relations between these documents”.

Hypertext reading comprehension: Chapter 3 summarised two theoretical frameworks that define reading comprehension. These two frameworks provide the simple view of comprehension (Gough et al. 1996; Hoover & Gough 1990) and the RAND reading comprehension model (Snow 2001). In particular, the RAND reading comprehension model addresses the features of hypertexts when defining reading comprehension. In general, the RAND reading comprehension model suggests that comprehending hypertexts consists of the interactions amongst readers, hypertexts and activities that include comprehension. The present study follows this definition of hypertext reading comprehension, since the present study investigates NESB participants’ (readers) hypertext (texts) comprehension performance before and after training.

Reading comprehension strategies: Afflerbach, Pearson and Paris (2008) maintain that reading comprehension strategies are goal-oriented tools that lead readers to reach understandings of texts. Cognitive and metacognitive reading comprehension strategies are used in the present study for instructional purposes. Also, hypertext reading comprehension strategies selected from (Salmeron et al. 2010) and Sutherland’s (2002) conclusions and suggestions are also taught to students.

Metacognition: Prior studies have defined metacognition in different ways. The present study follows Flavell’s (1979, p.906) definition: "Metacognition is knowledge and cognition about cognitive phenomena".

Students from non-English speaking backgrounds: Chapter 4 discussed two definitions of students from non-English speaking backgrounds (i.e. Pithers and Lim 1997 and Mulligan and Kirkpatrick 2000). The present study uses Mulligan and Kirkpatrick’s (2000, p.314) definition, which states “students from non-English speaking backgrounds are those who were born in non-English
speaking countries, speak languages other than English at home and have stayed in an English speaking countries for less than 10 years”. In other words, the present study focuses on international students’ hypertext comprehension behaviour.

5.5 Participants

Forty-nine international students participated in the experiment. All participants were undertaking post-secondary courses in Swinburne University of Technology. The experiment consisted of three phases. The overall design and layout of each phase was identical. The detail of participants in each phase is elaborated below.

Phase One. Thirty-one students undertaking the Unilink program at Swinburne College took part in this research. All participants came from non-English speaking backgrounds and included students from China, Vietnam, Indonesia, Thailand and Columbia. Unilink is a program that aims at improving students’ academic English skills, as well as their domain knowledge in business subjects. The pathways to this program include a direct entry. Alternatively, if they have qualifications from a Foundation Year program, they are still able to enter the Unilink program. Students who pass English for Academic purposes (EAP), and/or who have completed Year 12 VCE English, or Year 12 English as a Second Language (ESL), are eligible to take part in the Unilink program. These requirements aim at ensuring students’ English language skills are at the same level. The Unilink program runs for two semesters, four subjects covered in each one. Students learn business related subjects such as Management, Accounting and Micro-economics. There are two language and culture related subjects called Academic Culture & Communication, and Business Culture & Communication. Students who pass all eight subjects in the Unilink program are eligible to carry on their study in the second year of university undergraduate
study. Students who took part in this research were from groups undertaking Academic Culture & Communication.

Phase Two. Seven students took part in the second phase of the experiment. All participants came from China. They were undertaking their Bachelor degrees in e-commerce. The Bachelor degree they undertook is a joint degree offered by Nanjing Chinese Medical University and Swinburne University of Technology. They were required to accomplish a two-and-a-half-year Bachelor education in Nanjing Chinese Medical University, and continue a one-and-a-half year Bachelor degree program at Swinburne University of Technology. The experiment was carried out during their first semester in Swinburne University of Technology (i.e. the second half of their third year Bachelor degree). Management subjects are mandatory in their Bachelor degrees. It was reported by subject conveners and tutors that these students had experienced difficulties in terms of comprehending learning materials and writing assignments. Thus, this cohort of students was recommended to take part in the present study, in order to improve their reading comprehension skills.

Phase Three. Eleven participants took part in this phase. These international students were undertaking a Diploma of Hospitality or Diploma of Marketing in the TAFE division of Swinburne University of Technology. The students could apply to get to the course directly after finishing equivalent of Year 12 in their home countries. Also, international students who have completed Year 12 VCE English, or Year 12 English as a Second Language (ESL), are eligible to undertake a TAFE education. Business management is a core subject for TAFE students who are undertaking the Diploma of Hospitality or Diploma of Marketing. The current study was incorporated into a training program aimed at improving international TAFE students’ oral and written communication skills. The principal supervisor of the current study was in charge of teaching students to incorporate information from various sources into their written assignments. The author was
in charge of teaching participants to apply metacognitive reading comprehension strategies, cognitive strategies as well as hypertext reading strategies.

Before the experiment commenced, participants were given explicit instructions and explanations of the current research project. Furthermore, they were given consent statements written in plain English to get further information about the study and potential benefits. Finally, they were asked to sign consent forms to declare their participation. The students were told that participation in the program was voluntary and they could withdraw from the research at any time. Also, this would have no influence on their academic results.

5.6 Instruments
The major instruments used in the research were computers, hypertexts and reading tasks.

5.6.1 Computers
Students had all seven sessions in a computer lab, where each student had access to a computer and the Internet in each experimental phase. They were asked to accomplish all comprehension tasks individually. Group discussions were excluded from the pre- and post-tests, as well as the reading comprehension exercises in training sessions.

5.6.2 Hypertexts
A website was designed specifically for the current research project. Students were able to access hypertexts from the Web (refer to the attached CD). Two types of hypertext structure were used in the present study: the linear structure and the hierarchical structure. Under the linear structure readers followed pre-defined reading sequences set up by the designer. When readers finished reading the content in links, they had to go back to the main text, since no further
links were presented. However, more links were included in the hierarchically structured hypertexts, so that readers clicked on links at different levels of a hierarchy, and read all information presented. Participants were not able to access any other websites from hypertexts used in the present study. The use of online translation software or online dictionaries was strictly restricted. Figure 5.1 shows two different types of hypertext structures used in the present study.

![Figure 5.1 Two types of hypertext structures used in the present study](image)

In terms of organising information, hypertexts used in the research project were designed based on rationality principles (Fastrez 2002). According to Fastrez (2002) the choice of hypertexts should be made based on the nature of tasks that readers/students are requested to complete. Rationality principles refer to designing instructional hypertexts when students/readers are asked to do problem-solving, or learning-by-doing tasks. On the other hand, if browsing and searching processes play essential roles in tasks, functionality principles are an appropriate choice. Functionality principles refer to designing hypertext systems that support readers to establish their individual navigation paths through systems. However, navigation is not normally demanded if rationality principles
are used. Moreover, hypertexts can be organised with either hierarchical or linear structures when rationality principles are used. In the current research project, hypertexts had linear and hierarchical structures, with limited numbers of links for instructional and educational purposes.

Topics of hypertexts were chosen from management articles and textbooks, including organisational learning, knowledge management, learning organisations, total quality management and business process re-engineering. Content was re-written and re-organised by the author. The overall hypertext design procedures follow Jonassen’s (1986) principles. They include:

1. Identifying all key concepts. Relevant concepts formulate nodes and link structures in hypertexts. Thus, the first thing that needs to be done is to list all key concepts in a domain of knowledge. Next, designers should try to associate all key concepts in the domain with the help from glossaries if necessary. Also, designers should edit their key concepts lists so that they can delete irrelevant terms. The final version of the key concepts list will become nodes included in hypertexts. In this study key concepts are related to organisational learning, knowledge management, learning organisations, total quality management and business process re-engineering. Also, a number of sub-key concepts are included, such as marketing orientation, human resources management, e-commerce and e-business.

2. Mapping the structure of the content. At this stage, designers define interrelationships between key concepts. They can use different mapping tools to determine interrelationships between concepts, based on which they establish links. In this research, the author uses the networking mapping tool developed by Dansereau and Holley (1982). The theory emphasises that text structures can be defined from either the chain perspective or the hierarchy perspective. The chain perspective suggests
that the information or concept in one node leads to, or results in, the information or concept in another node. This perspective was used in designing linearly structured hypertexts. The hierarchy perspective argues that content in a lower node is part of the information in a higher node. This perspective was employed when designing hierarchically structured hypertexts.

3. Verifying the structure. Designers are also advised to ask specialists in targeted domains to review links set up by designers, using the same mapping mechanism. This is to test the validation of links from subject matter perspectives. A management subject convenor was asked to examine the validation of nodes and links designed by the author.

4. Determining the type of hypertext structure. Designers should decide what types of hypertext structure they would like to use. Their decisions should reflect interrelationships established by designers at stage 2. Hypertext structures used in this study include a linear structure and a hierarchical structure.

5. Preparing the concept blocks. Designers should write texts based on each key concept for individual nodes. They are also advised to ask subject matter experts to review their texts. The author had done extensive research and reading on materials related to key concepts in the current study. All hypertexts were written based on knowledge and information from reputable sources, including textbooks and journal articles from various online databases. The content of hypertexts was also carefully reviewed by a management subject convenor, in terms of the validation of interrelationships among nodes, and information and knowledge included.
6. Providing links and cues to other concepts. At this point, designers consider how nodes and links need to be organised. They can offer menu bars or use icons that support users to scroll forwards and backwards. In the current research project, HTML technology has been used as the platform to display all hypertexts. The author embedded all links in texts, and used a menu bar on the right-hand side of each interface. From the menu bar, participants were able to access to hypertexts used in any session in the experiment.

7. Debugging the system. Lastly, designers should test how their systems work and detect any possible errors. In this case, designers make sure their systems are user-friendly and working well without technological faults. The author tested the whole hypertext system used in the study before the experiment commenced. In addition, the author had back-up CDs in case any technological errors occurred during the experiment.

The overall screen display pattern used in this research was based on the format...
proposed by Hemard (1997). Hemard (1997) suggests that appropriate screen divisions should be established, and informational areas should occupy a central position. Two types of screen display patterns are shown as follows (Figure 5.3). The style used in the study is similar to Type B. Area B is the central informational area, which displays main tests; Area A is used for menu bars; Area C presents key words of other relevant links.

Adjustment was made while presenting information based on Type B shown in Figure 5.2. Area B was enlarged, given hypertexts were mainly presented in this area. Area A and Area C were smaller than what was shown in Figure 5.3, since they were used to present links and relevant key words.

According to Hemard (1997), it is recommended that fonts used in hypertext design should be either slab-serif or sans-serif fonts. The font used in this research project is Arial, which is under the category of sans-serif fonts. The spacing is 1.5, which also follows Hemard’s (1997) suggestion. Also, normal mixed-case texts are used in this research, which is in line with recommendations made by Isaacs (1987). Colours used in web pages are
limited, in order to reduce demands on students' working memory (Hemard 1997). Texts in all nodes are organised in recognisable paragraphs and left-justified, which is also in line with Hemard's (1997) research.

The number of links used in each session varied. However, the number of links in linearly structured hypertexts and hierarchical ones in each session was the same. There were nine links involved in both the pre-test and the post-test. Five links were used in the first two training sessions, seven links in the third and the fourth training sessions, and nine links in the fifth training session.

A readability test had been done prior to the experiment commencing. A readability test assesses levels of difficulty of reading materials (Flesch 1948). The readability test mechanism used in this study is the Flesch-Kincaid readability test. Two components were included in the test, known as the Flesch Reading Easiness and the Flesch-Kincaid Grade Level. This mechanism included two variables: the average number of syllables per word in texts of about 100 words, and the average number of words per sentence. The Flesch Reading Ease scores employ a reading ease index of 0 to 100. The higher the score, the easier the text, the lower the score, the harder the content. The Flesch-Kincaid Grade Level scores are related to a numerical grade. For instance, a score of 9.8 indicates the reader should be educated for 9.8 years to understand a text. The relationship between the Flesch Reading Ease scores and the Flesch-Kincaid Grade Level scores is shown in Table 5.1 below (Flesch 1949).
Table 5.1 Flesch Reading Ease Table

<table>
<thead>
<tr>
<th>Flesch-Kincaid Reading Ease Score</th>
<th>Average Sentence Length in Words</th>
<th>Estimated School Grade Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 - 100</td>
<td>8 or fewer</td>
<td>4th Grade</td>
</tr>
<tr>
<td>80 - 90</td>
<td>11</td>
<td>5th Grade</td>
</tr>
<tr>
<td>70 - 80</td>
<td>14</td>
<td>6th Grade</td>
</tr>
<tr>
<td>60 - 70</td>
<td>17</td>
<td>7th or 8th Grades</td>
</tr>
<tr>
<td>50 - 60</td>
<td>21</td>
<td>Some high school</td>
</tr>
<tr>
<td>30 - 50</td>
<td>25</td>
<td>High school or some college</td>
</tr>
<tr>
<td>0 - 30</td>
<td>29 or more</td>
<td>College</td>
</tr>
</tbody>
</table>

(Source: Flesch (1949). The art of readable writing, p. 149)

The above table indicates different ranges of Flesch Reading Ease scores that match different levels of education. The readability of all hypertexts used in the present study falls into the 30-50 Flesch Reading Ease score category. This level matches participants’ current level of education and level of the English language.

5.6.3 Instructional materials

Besides hypertexts, instructional materials presented in Powerpoint slides format were shown via projectors in all training sessions. Powerpoint slides used in training sessions (Appendix III) contain explicit instructions on metacognition and the use of metacognitive strategies and cognitive strategies, as well as how to read hypertexts properly in light of the above strategies. All students were given a print copy of this particular instructional material. During training sessions 2-5 the theory was revised; however, the review time became shorter as time passed, since it was assumed that students were becoming more sophisticated as the training progressed (Verezub et al. 2008).
The design of instructional materials combines metacognitive strategies introduced by Palincsar and Brown (1989), and teaching web reading principles proposed by Sutherland (2002a, b), along with teaching a suite of cognitive strategies. Palincsar and Brown’s (1989) theory proposes six metacognitive strategies that both monitor and foster comprehension:

1. Clarifying the purpose of reading to decide appropriate approaches to complete reading tasks;
2. Activating background knowledge to generate connections between what is known and the new information in the text;
3. Allocating attention so that major content becomes the focus;
4. Evaluating content critically based on prior knowledge and common sense;
5. Monitoring reading processes to determine if comprehension happens;
6. Evaluating reading processes and adjusting comprehension approaches if necessary.

The language used in instructional materials was suitable for participants’ current level of the English language and prior knowledge. Additionally, explicit explanations were made during all training sessions, so that students fully understood each strategy.

Sutherland-Smith (2002a) proposes eight teaching principles for online reading, including:

1. Grasping key words in each node;
2. Focusing on refining keyword searches;
3. Providing clear search guidelines;
4. Breaking long texts into short paragraphs or passages;
5. Developing teaching mechanisms to overcome frustration with technology;
6. Providing shortcut lists to sites or search engines;
7. Having limited numbers of links;
8. Evaluating nontextual features, such as images and graphs.

The above teaching principles are designed, based on online searching, navigating and reading class activities. However, no searching activities were involved in this research project. Moreover, only limited navigational activities were required. Thus, hypertext reading instruction in the study was illustrated based on the above eight principles, in conjunction with recommendations from another article by Sutherland-Smith (2002b). Hypertext reading strategies taught in the present research were as follows:

- Try to identify keywords in each link;
- Open each link in a new window or a new tab to keep you aware of your current position;
- Connect contents in individual links to main texts;
- Connect contents of links to each other;
- Try to use various cognitive reading strategies, such as summarising and paraphrasing, to achieve comprehension;
- Use metacognitive strategies to get our reading processes organised and under control.

Apart from metacognitive strategies and instructional principles, the use of cognitive strategies is also covered in instructional materials. It is suggested that most NESB students have been taught cognitive strategies before they start studying in English speaking countries. However, they may not know the particular terminology of those cognitive strategies in English (Lawrence 2007). Therefore, five frequently used cognitive strategies were included in instructional
materials as a reminder to students. In this case, while reading online, students were able to use cognitive strategies to generate basic understanding, and use metacognitive strategies to monitor and evaluate their individual reading processes. Five cognitive strategies used in this study include (Lawrence 2007):

1. Summarising – to identify main idea(s) of texts;
2. Paraphrasing – to re-word or re-phrase what has been read in readers’ own words;
3. Visualising – to formulate pictures or images of what has been read in readers’ minds to foster comprehension;
4. Predicting – to estimate what readers are going to read based on titles, subtitles and other key words in texts;
5. Making connections – to link what has been read to what readers have already known.

However, in order to avoid participants’ misunderstanding and confusion during the experiment, the word ‘strategy’ was only used when the trainer was instructing metacognition and metacognitive strategies.

5.6.4 Reading tasks
This research assesses students’ comprehension performance by using three types of comprehension questions: literal, inferential and critical. Students had an equal number of the above three types of questions in each session. Literal questions deal with information stated explicitly in texts. Readers are able to locate answers in texts fairly easily, as long as they understand what words and sentences literally mean. An example of literal questions is “Why is organisational learning conducted?” (session1). Inferential questions require students to go beyond what is stated and read between lines. At this stage, students need to make connections between different sections in a text and understand the writer’s ideas. An example of inferential questions is “Can you
explain how effectiveness and efficiency contribute to organisational learning?" (session 1). Critical questions ask students to evaluate and make critical judgements about what is read. At this level, students should be able to link what is read to what they already know. An example of critical question is “Why does technology development have influence on organisational change?” (session 1).

The underpinning theory for the current research is the Hypertext Reading/Comprehension Model proposed by Protopsaltis and Bouki (2005). This model has been developed based on Kintsch’s Construction-Integration model (Kintsch 1998, 1988) in conjunction with navigation principles. Eleven components are included in this model. These components have been elaborated in Section 3.4.2. Its relevance to the present study is presented below.

1. Formatting of a goal or task. Goals define link selections and reading sequences. In the current study, students were told to establish goals for reading, based on the tasks they were given.

2. Scanning the categories of information. Readers roughly scan webpages they read at this point. In this research project, although webpages were designed with a limited number of links, key words of each link were still presented on the right hand side of webpages. In this case, participants were able to have a quick scan on information they would read.

3. Reading the categories of information. Readers select links and determine their reading orders based on their goals. At this stage, participants read hypertexts to form surface code mental representations of hypertexts.
4. Building the textbase representation. Readers start making basic inferences and grasp the semantic meaning of sentences, paragraphs and/or nodes. In the current research project, literal and inferential comprehension questions were used to reflect this level of comprehension.

5. Building the situational model. Readers begin to establish a network of main ideas of texts at this point. Critical questions were used in the present study to reinforce this level of comprehension.

6. Using appropriate strategies. The current research has limited participants’ freedom in selecting links. However, participants were taught various strategies (i.e. metacognitive strategies, cognitive strategies and hypertext reading strategies) to achieve hypertext comprehension. They were encouraged to choose appropriate strategies and apply them while reading hypertexts.

7. Monitoring reading comprehension. Since metacognition and metacognitive strategies were taught in the present study, participants were encouraged to use their knowledge of metacognitive strategies to take the control over their reading processes.

8. Following the appropriate path. Due to the limited number of links presented in the current research project, these navigational activities were limited as well. Only participants who read hierarchically structured hypertexts had chances to navigate through limited links.

9. Repeating as many times as necessary. In this research project, participants were allowed to repeat the above process, as long as they could complete reading tasks in time.
10. Accomplishing of readers’ goals. Readers should check if their goals are met when they finish reading. In this research, participants were taught to use their metacognition to evaluate and review their reading processes.

11. Recycling if comprehension fails. Participants were encouraged to read metacognitively to detect any comprehension failure in the present study. If they found any errors or failure, they were taught to adjust their reading strategies and re-evaluate their reading processes.

5.7 Procedures

Three experimental phases were employed in the current study. Each phase consisted of seven one-hour sessions. They were delivered to students on a weekly basis, including a pre-test, five training sessions and a post-test. The information delivered in training sessions, in all phases, was the same. However, the language used in different phases was adjusted in accordance with participants’ levels of the English language. In each experimental phase, participants were randomly assigned into two groups. One group of participants read hypertexts with a linear structure; the other group of participants read hypertexts with a hierarchical structure. Each of the groups was allocated one hour per week over seven weeks. Numbers of links and types of comprehension questions (i.e. literal questions, inferential questions and critical questions) were identical for both linearly and hierarchically structured hypertexts. Comprehension tasks used in the present study (including the pre-test, training sessions and the post-test) were printed on A4 paper with sufficient space for students to write their answers. Topics and the readability of hypertexts in each session were similar for linearly and hierarchically structured hypertexts.

Pre-test. Before the pre-test began, students were assigned a particular code for
this research so that their names and ID numbers did not appear on any answer sheets or relevant documents. In the pre-test, students were told to read online and complete reading tasks. Also, they were reminded to click on all links as long as they saw them on screens. Nine links and nine comprehension questions (three literal questions, three inferential questions and three critical questions) are used in the pre-test. Students were allowed to complete reading and question answering in 45 minutes. The length of hypertexts (both with linear and hierarchical groups) was approximately 1000 words. The feedback was given to students in the second training session.

The overall organisation of five training sessions follows Duffy’s (2002) instructional principles of reading comprehension:

1. Providing a brief overview of what is to be read. A brief overview of content, including strategies to be taught, as well as topics to be read, was given to students at the beginning of each training session.

2. Teaching reading comprehension strategies. The author provided explicit explanations of each strategy (including metacognitive strategies, cognitive strategies and hypertext reading strategies) with simple and clear examples.

3. Provide mental modelling. The author gave examples of applications of strategies in the instruction. Examples were selected based on participants’ subject matter materials, hypertexts they read in the present study, as well as their personal online reading experiences (such as Facebook and Wikipedia).

4. Practicing strategies. Students were asked to read hypertexts and answer comprehension questions by applying strategies taught in the instruction.
since the second training session. Some supervision was provided by the trainer. The assistance and supervision from the trainer decreased gradually in each session, as the training program carried on.

5. Getting sophisticated. Numbers of links and comprehension questions increased session by session. Students were encouraged to apply strategies independently as the experiment progressed.

6. Recapping strategies. Hypertext comprehension exercises were followed by a brief review of the training session. The author reinforced the importance of strategies taught in the training program and encouraged participants to apply these strategies as often as possible in their daily study.

All instructional materials were presented in Powerpoint slide format, and were shown via a projector in all training sessions. The overall layout of each session is elaborated as follows.

Training session 1. At the beginning of the session, students were asked to recall their individual reading experiences from their daily lives, for instance how they read learning materials every day (these could be either hard copies or electronic copies), as well as how they read online information. Then feedback of the pre-test was delivered to students. The author went through all the questions involved in the pre-test with the expected answers. Students were given a brief outline of the day’s session, followed by a detailed explanation of reading strategies (refer to Section 5.6.3 for strategies taught in the training) in the hypertext context. Simple and clear examples were given to illustrate how these strategies could be applied alongside the theory instruction. Students were also given a short passage in order to practice strategies that they had just learnt. They were also encouraged to give their answers when they finished reading
and share their experiences of theory application. Moreover, students were
given print copies of instructional materials at the end of the first training session
so that they could review theoretical information taught in the session. They
were also encouraged to apply strategies they learnt to their reading activities for
their own study. Students were also told what would be covered in the next
training session, before the session terminated.

Training session 2. Students had both theory instruction and hypertext reading
practice in this session. Prior to theory revision and instruction, students were
encouraged to share their experiences of reading (including reading hypertexts
and traditional paper-based texts) in the previous week with the help of
strategies covered in training session 1. Explicit revision was given to students,
so that they could refresh their memory and gradually recall theories covered in
the previous session. Again, simple and clear examples were given to students.
These examples were related to learning materials in their business subjects.
Before commencing reading, a brief introduction to the topics that participants
were about to read was given to students. In this session, students were asked
to apply strategies collaboratively in their hypertext reading. The first group was
given a hypertext with linear structure, and the second one was given a
hypertext with hierarchical structure. Both types of hypertexts had 5 links and
contained approximately 500 words. In this session, participants applied
strategies taught in the first training session, while reading hypertexts with the
assistance of the author. They were encouraged to ask questions and/or
express their confusion in terms of theory application at any stage, while reading
online. Students were given 30 minutes to finish reading and then answer
comprehension questions, which included one literal question, one inferential
question and one critical question. Answer sheets were collected by the author,
and a brief review of the session and what would be covered in the following
week were given to participants.
Training session 3. Core activities in training session 3 consisted of releasing results, revising reading strategies, reading hypertexts and answering comprehension questions. Results and feedback on reading hypertexts in training session 2 were given to students, prior to revision. Explicit explanation of the last session’s questions was given to students, followed by revision. During this revision students were asked to contribute their reading experiences and exchange opinions. Further, simple and sharp examples were used to remind students how to apply various strategies. Topics to be read during the session were briefly explained by the author. Students were asked to use strategies collaboratively under the supervision of the author this session. The length of hypertexts for both groups was approximately 600-700 words. Each hypertext contained five links followed by six comprehension questions (two literal questions, two inferential questions and two critical questions). Students were given 35 minutes to read the hypertexts and answer the questions. If participants encountered any difficulties while reading, they were encouraged to ask the author for assistance. Answer sheets were collected after reading, which was followed by a brief review of this session, and a clear introduction of the following session’s content.

Training session 4. In this session students received results of training session 3, as well as a revision of reading strategies and hypertext reading tips. The way students got their results and feedback in this session was the same as in training sessions 2 and 3. The revision got a bit shorter and briefer in comparison with the previous two training sessions. Similarly, participants were given opportunities to share their experiences of using various reading strategies in the previous week. Hypertexts read by both groups of students included 800-900 words, followed by six comprehension questions (two literal questions, two inferential questions and two critical questions). Again, students received a brief introduction to the day’s topics before reading commenced. Forty minutes was given to students to accomplish the reading and to answer questions. If
there were any questions or difficulties during the session, participants sought clarification from the author. Similar to training session 2 and 3, a brief session review and an introduction to the following session were done, before the session terminated.

Training session 5. In this session, key activities included a discussion of results from the previous session, reading strategies revision of cognitive, metacognitive and hypertext reading strategies and hypertext reading practices. Participants received results and feedback from the previous session, as in the previous three training sessions. Also, reading strategy application experiences were reviewed by the author. This review was a little shorter and briefer than in training session 4. Again, students received a brief explanation of the day’s topics before reading started. Hypertexts used in this session contained 900-1000 words. They had 9 links followed by 9 comprehension questions (three literal questions, three inferential questions and three critical questions). In this session students were encouraged to use strategies independently. They were asked to complete reading and question answering in 45 minutes. The brief review of the session and the following week’s plan were given to students after answer sheets were collected.

In general, training sessions included in the current study parallel a feedback-revision-practice-review approach. This particular layout is designed, based on four instructional phases suggested by Merrill (2002):

1. Activation of prior knowledge. Students obtained feedback from the previous session and were asked to share their individual experience of reading, especially in online reading.
2. Demonstration of skills. This is related to theory revision with examples covered in training sessions.
3. Application of skills. Students were asked to read hypertexts and answer
comprehension questions with the knowledge of metacognitive strategies, hypertext reading strategies, as well as cognitive strategies.

4. Integration of these skills into the real world. At the end of each session, students were also encouraged to use all theories in their Unilink study, and are welcomed to contribute their experience in the following session.

Post-test. The layout of the post-test was identical to the pre-test. Hypertexts in the post-test contained approximately 1000 words. Both groups read hypertexts with nine links and answered nine comprehension questions (three literal questions, three inferential questions and three critical questions). Forty-five minutes were allowed to complete reading and answer questions. After that, students were also asked to complete a post-test questionnaire. They were encouraged to express their attitude to hypertext reading. It was an anonymous survey process; thus, neither students’ names nor ID numbers were requested. Results and answer guidelines of training session 5 and the post-test were sent to the students Unilink class instructors via emails, one week after the completion of the program.

The overall presentation of each experimental phase was the same. However, the language used during instruction was adjusted, based on participants’ levels of the English language and their prior knowledge.

Marking system. Students got 1 point for a full and complete answer; 0.75 of a point was given to those who had minor errors in their answers; 0.5 of a point was given to those who answered questions partially correctly; 0.25 of a point was given to students who had made the attempt but had not got key points explained clearly. Zero points were given to an incomplete or incorrect answer. Both pre- and post-tests answer sheets were cross-marked by the authors’ principal supervisor.
5.8 Concluding remarks

This chapter has provided an overview of the methodology and research design of the present study. The current research aims at exploring the effect of reading strategy training on NESB students’ hypertext comprehension performance. Also, it looks at investigating the influence of different hypertext structures (i.e. a linear structure and a hierarchical structure) on NESB students’ hypertext comprehension results. The present study employed a quantitative research method. The experiment consisted of three phases, each of which included two experimental groups. Participants in each group were asked to read hypertexts with either linear structures or hierarchical structures. In each group, participants had received seven one-hour sessions, including a pre-test, five reading strategy training sessions and a post-test.

The design of hypertexts was based on theories and principles suggested by Fastrez (2002) and Jonassen (1986). In general, information presented in hypertexts was organised according to rationality principles, which maintained that hypertexts should be organised based on the nature of tasks. The hypertext design procedures followed the seven steps proposed by Jonassen (1986). Data collection was conducted based on participants’ hypertext comprehension results, as well as a post-test questionnaire. The layout of the pre- and the post-tests was identical. The underpinning theory of hypertext reading comprehension and its measurement in the present study was based on Protopsaltis and Bouki’s (2005) Hypertext Reading/Comprehension Model. In this model, comprehending hypertexts was completed in 11 steps. Topics of hypertexts used in each experimental group were similar. In each training session, two experimental groups read hypertexts similar in length, with the same number of hyperlinks and comprehension questions. The instruction approach and training materials were developed according to previous research on teaching reading comprehension strategies, in both the conventional
written-texts and hypertext contexts, and used Duffy’s (2002) and Merrill’s (2002) principles of instructions. Participants were taught different reading strategies and encouraged to apply them. In addition, answer sheets from the pre- and post-tests were cross-marked by the author’s principal supervisor.
Chapter 6
Results

Chapter 5 has presented the overview of the present study, as well as the research methodology. In this chapter, results of data analysis are elaborated in four sections according to the hypothesis of the present study. The first section presents the reading comprehension performance of the two experimental groups, which represents participants’ hypertext comprehension scores, both before and after they received the reading strategy training. Statistical analysis of the influence of reading strategy training on reading comprehension of hypertexts, with linear and hierarchical structures, is shown in the second section. This section is linked to Hypothesis 1 of the present study and discusses results that support this particular hypothesis. The third section presents results related to the influence of hypertext structures on students’ reading performance, before and after training. This section is connected to Hypothesis 2 of the present study, and compares participants’ hypertext comprehension performance, while comprehending hypertexts with linear or hierarchical structures. Students’ perception of, and attitude to, hypertext reading and strategy application are displayed in the fourth section. This data was collected from the post-test questionnaire. In this chapter, the term ‘experimental group’ is used to represent two groups of participants in the present study, who were assigned to comprehend hypertexts with either a linear structure or hierarchical structure (for detail of participants, instruments and comprehension measurement, please refer to Chapter 5).

6.1 Reading comprehension performance of two experimental groups
This section presents descriptive statistics of participants’ hypertext comprehension performance in the pre- and post-tests, for two experimental groups. The pre- and post-tests were designed identically. Students were given
45 minutes to read hypertexts with either a linear or hierarchical structure, and answer 9 comprehension questions, in both pre- and post-tests. Each hypertext, in both pre- and post-tests, contained 9 links. The maximum score in the pre- and post-test was 9 (for detail of methodology and experiment, refer to chapter 5). Means, standard deviations, skewness and kurtosis of hypertext reading comprehension scores for two experimental groups are shown in Table 6.1.

Table 6.1 Descriptive Statistics of comprehension performance by participants in two experimental groups

<table>
<thead>
<tr>
<th>Comprehension performance by participants in two experimental groups at two experimental stages</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearly structured hypertexts N=24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>3.75</td>
<td>1.4</td>
<td>1.75</td>
<td>7.00</td>
<td>0.85</td>
<td>0.38</td>
</tr>
<tr>
<td>Post-test</td>
<td>5.78</td>
<td>1.6</td>
<td>2.75</td>
<td>8.75</td>
<td>0.21</td>
<td>-0.74</td>
</tr>
<tr>
<td>Hierarchically structured hypertexts N=25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>2.32</td>
<td>0.5</td>
<td>1.00</td>
<td>3.25</td>
<td>-0.34</td>
<td>-0.69</td>
</tr>
<tr>
<td>Post-test</td>
<td>4.55</td>
<td>1.5</td>
<td>0.75</td>
<td>7.00</td>
<td>-0.56</td>
<td>-0.24</td>
</tr>
</tbody>
</table>

The upper row of Table 6.1 displays descriptive statistics of participants who comprehended linearly structured hypertexts in the pre- and post-tests. In the pre-test the mean of reading comprehension scores for linearly structured hypertexts is 3.78, SD=1.42. The lowest score is 1.75, while the highest score is 7. Typically 50% of participants had 3 to 4.75 points in the pre-test while reading hypertexts with a linear structure. In the post-test, the mean of reading comprehension scores of this group is 5.78, SD=1.66. The lowest score is 2.75 points, while the highest score is 8.75 points. Typically 50% of participants who read linearly structured hypertexts had 4.38 to 6.75 points in the post-test.
On the other hand, the lower row of Table 6.1 contains participants' hypertext comprehension performance in the group where hierarchically structured hypertexts were comprehended. The mean of reading comprehension scores of this group in the pre-test is 2.32 SD=0.59. The lowest score is 1 point, while the highest score is 3.25 points in this group. Typically 50% participants of this group had 1.75 to 2.75 points in the pre-test. The mean of reading comprehension scores of participants who read hierarchically structures in the post-test is 4.55, SD=1.58. The lowest score in the post-test is 0.75 point, while the highest score is 7 points. Typically 50% participants had 3.25 to 5.75 points in the post-test.

According to Tabachnik and Fidell (1996), the measures of skewness and kurtosis in both experimental groups in the pre- and post-tests indicate that the distribution of comprehension scores does not differ from a normally distributed set of scores. Normal distributed data would make values of skewness and kurtosis zero. However, calculated values of skewness and kurtosis will rarely be equal to zero. For a real data set, these values can be either positive or negative numbers. Even when a population distribution has zero skewness and kurtosis, the samples taken from it will produce values that are not zero. In order to test the distribution of data, calculated values of skewness and kurtosis are compared to two standard errors of skewness and kurtosis respectively. Calculated values of skewness and kurtosis are considered to be significant, or data non-normal, when they are greater than 2 standard errors of skewness and kurtosis. Tabachnick and Fidell (1996) suggest the standard error of skewness (SES) and kurtosis (SEK) can be estimated as:

$$SES = \sqrt{\frac{6}{N}}$$

$$SEK = \sqrt{\frac{24}{N}}$$

where N is the sample size.
Skewness is deemed to be significant when a calculated value of skewness is greater than $2 \times \sqrt{\frac{6}{N}}$. Kurtosis is deemed to be significant when a calculated value of kurtosis is greater than $2 \times \sqrt{\frac{24}{N}}$.

The SES of data collected from the group of participants who comprehended linearly structured hypertexts was 0.5. Thus, 2 standard errors of skewness should be 1. Calculated values of skewness of the pre-test (0.85) and the post-test (0.21) data are not greater than 1. The SEK of the same group was 1. Thus, 2 standard errors of kurtosis should be 2. Calculated values of kurtosis of the pre-test (0.38) and the post-test (-0.74) data are less than 2. Thus, neither obtained values of skewness nor kurtosis are significant. In other words, the distribution of data collected from this group is normal.

The SES of data obtained from the group of participants who comprehended hierarchically structured hypertexts was 0.49. Thus, 2 standard errors of skewness should be 0.98. Calculated values of skewness of the pre-test (-0.34) and the post-test (-0.56) data do not exceed the value of 2 standard errors. The SEK value of this group was 0.98. Thus, 2 standard errors of kurtosis should be 1.96. Calculated values of kurtosis of the pre-test (-0.69) and the post-test (-0.24) data are less than 1.96. Therefore, both calculated values of skewness and kurtosis are insignificant. In this respect, the data acquired from this group is distributed normally.

Figure 6.1 shows the comparison of means, minimum scores, and maximum scores of comprehension performance by participants in the two experimental groups at two experimental stages. It provides an overview of participants' hypertext comprehension performance at the two experimental stages, in the two experimental groups.
Figure 6.1 shows means, minimum scores and maximum scores of hypertext comprehension performance by all participants at the two experimental stages. For participants who read linearly structured hypertexts, their hypertext comprehension performance in the post-test is better than in the pre-test. Participants who comprehended hierarchically structured hypertexts obtained better hypertext comprehension scores in the post-test than in the pre-test. Section 6.2 discusses the association between the experimental groups (i.e. the group that comprehended linearly structured hypertexts and the group that comprehended hierarchically structured hypertexts) and the experimental stages (i.e. pre-tests and post-tests).
6.2 The influence of training and structures on hypertext comprehension performance

Hypothesis 1 of the present study aimed at exploring the influence of reading strategy training on hypertext comprehension performance. The General Linear Model was used to confirm this particular association, and to explore the interaction between the hypertext structures (a linear structure and a hierarchical structure) and the experimental stages (the pre-test and the post-test). Hypothesis 1 predicted that NESB students' hypertext comprehension would improve when reading hypertexts with linear and hierarchical structures, after reading strategy training. A 2(stages) \times 2(structures) analysis of variance (ANOVA) with an interaction plot was carried out on data, in order to test Hypothesis 1. The 2(stages) \times 2(structures) analysis of variance (ANOVA) revealed that the stage main effect was significant, F(1,97)=57.86, p<0.050. In other words, means of participants' hypertext comprehension performance results in both groups in the post-test significantly differed from their results in the pre-test. Figure 6.2 reveals the interaction between the stages and the structures in the research.
Figure 6.2 shows that the lines, representing the two experimental groups’ means, go up towards the same direction. They indicate that participants’ hypertext comprehension performance in both groups increased significantly after reading strategy training. Thus, it confirms the association between reading comprehension strategy training and hypertext comprehension performance. In this respect, participants’ hypertext comprehension performance was enhanced after the reading comprehension training, regardless of the hypertext structures used to link information. In order to test Hypothesis 1, paired sample t-tests were conducted on the data. The results of paired sample t-tests are presented in Section 6.3.
Hypothesis 2 predicted that participants who read hypertexts with a linear structure would outperform those who read hypertexts with a hierarchical structure. A 2(structures) x 2(stages) analysis of variance (ANOVA) indicated that the structure main effect is significant, F(1,97)=23.45, p<0.050. It reveals that means of hypertext comprehension results of participants who comprehended linearly structured hypertexts significantly differ from means of hypertext comprehension performance of participants who comprehended hierarchically structured hypertexts in both pre- and post-tests. Figure 6.3 indicates the interaction between structures and stages.

![The interaction plot between hypertext structures and experimental stages](image)

Figure 6.3 The interaction between hypertext structures and experimental stages
Figure 6.3 shows the two lines that represent the two experimental stages go towards the same direction. It reveals that means of comprehension scores by participants who read hypertexts with linear structures are higher than means of comprehension scores by participants who read hypertexts with hierarchical structures, before and after the reading comprehension strategy training. In this regard, participants who read linearly structured hypertexts outperformed those who comprehended hierarchically structured hypertexts, regardless of receiving the reading comprehension strategy training or not. Independent sample t-tests were used to compare means and standard deviations of comprehension scored from two experimental groups, before and after the training. Results are elaborated in Section 6.4.

Although both stage and structure main effects were significant, the interaction between stages (i.e. the pre- and post-tests) and structures (i.e. the linear structure and the hierarchical structure) was not significant, $F(1,97)=0.17$, $p>0.050$. It indicates that the significant difference between means of comprehension results of participants in both experimental groups before and after the training is not influenced by different hypertext structures. It also reveals that the reading comprehension strategy performance has no impact on the significant difference of means between comprehension results of participants who comprehended linearly structured hypertexts and comprehension results of participants who comprehended hierarchically structured hypertexts.

6.3 The influence of reading strategy training on two experimental groups' hypertext comprehension performance

Hypothesis 1 predicted that reading comprehension strategy training would enhance NESB students’ hypertext comprehension performance when they read linearly or hierarchically structured hypertexts. The $2(\text{stages}) \times 2(\text{structures})$ analysis of variance confirmed the association between reading comprehension
strategy training and the improvement of NESB participants’ hypertext comprehension performance. Paired sample t-tests were conducted on data in order to further explore the influence of reading comprehension strategy training on the improvement of hypertext comprehension performance.

In Hypothesis 1, the null hypothesis stated that reading comprehension strategy training had no influence on hypertext reading comprehension when students read hypertexts with a linear structure. Twenty-four participants took part in both the pre- and the post-test to read hypertext with a linear structure. On average, the mean comprehension score in the post-test, when reading linearly structured hypertexts, is higher (Mean= 5.78, SD= 1.166) than those in the post-test, when reading hypertexts with the same structure (Mean= 3.75, SD= 1.42). Figure 6.4 shows means of comprehension scores by NESB participants who read linearly structured hypertexts in the pre- and the post-tests.
Figure 6.4 The comparison of comprehension scores by participants who read linearly structured hypertexts in both experimental stages

Figure 6.4 indicates that the mean comprehension score in the post-test is higher than that in the pre-test by participants who read hypertexts with a linear structure. A paired sample t-test reveals that the difference between means of comprehension scores from the pre- and the post-test is significant – $t=8.94$, $p<0.050$. The 95% confidence interval indicates that the difference between pre- and post-tests is significant. Thus, the null hypothesis is rejected. As expected, reading comprehension strategy training enhances NESB participants’ comprehension results, when reading linearly structured hypertexts.

In hypothesis 1, the null hypothesis also predicted that reading strategy training had no influence on comprehension performance when students read
hierarchically structured hypertexts. Twenty-four NESB participants participated in both the pre- and the post-test to read hypertexts with hierarchical structures. On average, the mean comprehension score, when reading hierarchically structured hypertexts by NESB students after the training (Mean=4.56, SD=1.58), is higher than that before the training (Mean=2.32, SD=0.59). Figure 6.5 shows means of comprehension scores by NESB participants who read hierarchically structured hypertexts in the pre- and the post-tests.

![The comparison of comprehension scores before and after the training](image)

Figure 6.5 The comparison of comprehension scores by participants who read hierarchically structured hypertexts in both experimental stages

Figure 6.5 indicates that the mean comprehension score in the post-test is higher than that in the pre-test by NESB participants who read hierarchically structured hypertexts. A paired sample t-test shows that the difference is significant, t=7.10 p<0.050. The 95% confidence interval indicates that the
difference between pre- and post-tests is significant when reading hierarchically structured hypertexts. In this sense the null hypothesis is rejected. As expected, NESB participants’ comprehension performance has been significantly improved after reading comprehension strategy training, while reading hypertexts with a hierarchical structure.

In general, the results indicate that Hypothesis 1 of the present study is supported. NESB participants’ hypertext comprehension performance in both experimental groups was significantly enhanced by reading comprehension strategy training. In other words, the reading comprehension strategy training that participants received helped them improve their hypertext comprehension performance.

### 6.4 The influence of hypertext structures on students’ reading performance before and after the training in two experimental groups

It was hypothesised by Hypothesis 2 that NESB students’ reading comprehension of linearly structured hypertexts would be greater than that of hierarchically structured hypertexts, both before and after training. A $2(\text{structures}) \times 2(\text{stages})$ analysis of variance (ANOVA) has asserted that NESB participants who read linearly structured hypertexts, outperform NESB participants who read hierarchically structured hypertexts, in both experimental stages.

In Hypothesis 2 the null hypothesis predicted that there would be no difference between comprehension scores for linearly and hierarchically structured hypertexts, before the training was implemented. The mean of comprehension results for linearly structured hypertexts (Mean=3.78, SD=1.42) was higher than the mean of comprehension scores for hierarchically structured hypertexts (Mean=2.32, SD=0.59). Figure 6.6 shows means of comprehension scores in
the pre-test, by participants who read linearly structured hypertexts and participants who read hierarchically structured hypertexts.

Figure 6.6 The comparison of comprehension scores by participants in both experimental groups in the pre-test.

Figure 6.6 indicates that the mean of comprehension scores by NESB participants who read linearly structured hypertexts in the pre-test is higher than those who read hierarchically structured hypertexts, in the same experimental stage. Two sample t-tests reveal that this difference is significant, t=4.66, p<0.050. Thus, the null hypothesis is rejected. As expected, NESB participants' comprehension performance is greater when they read hypertexts with linear structures than when they read hypertexts with hierarchical structures, before reading strategy training.

The null hypothesis in Hypothesis 2 also predicted that NESB students' comprehension results, when reading hypertexts with a linear structure and a hierarchical structure, would be similar after reading comprehension strategy
training. It was assumed that NESB students’ comprehension performance of hypertexts with a linear structure would be greater than that of hypertexts with a hierarchical structure, after the training. The mean of comprehension performance for linearly structured hypertexts (Mean=5.78, SD=1.66) was greater than the mean of comprehension results for hierarchically structured hypertexts (Mean=4.56, SD=1.58). Figure 6.7 shows means of comprehension scores by participants in two experimental groups in the post-test.

![The comparison of comprehension scores across two experimental groups after the training](image)

Figure 6.7 The comparison comprehension scores by participants in two experimental groups in the post-test

Figure 6.7 indicates that the mean of comprehension scores by participants who read linearly structured hypertexts in the post-test is higher than the mean of comprehension scores by those who read hierarchically structured hypertexts, in the same experimental stage. Two sample t-test reveals that this difference is significant, t=2.66, p<0.050. Therefore, the null hypothesis is rejected. As
predicted, NESB participants' comprehension scores of hypertexts with a linear structure are greater than their comprehension scores of hypertexts with hierarchically structured hypertexts, after training.

To sum up, Hypothesis 2 of the present study is considered valid. NESB participants who comprehended linearly structured hypertexts outperformed those who comprehended hierarchically structured hypertexts, both before and after the reading comprehension strategy training. In this sense, NESB participants tended to produce better comprehension performance when reading linearly structured hypertexts than reading hierarchically structured hypertexts.

6.5 Students' attitudes to reading hypertexts and strategy application

Students were asked to complete a post-test questionnaire after the post-test (Appendix VII). The questionnaire aimed at exploring students' attitudes to applying strategies when reading hypertexts. Questions 1 to 5 asked students to provide certain background information about themselves, including their levels of education, country of origin, languages spoken at home, degrees they are undertaking, and years of English language study. On average, participants have spent 8 years on the English language study. Languages they speak at home include Chinese, Spanish, Thai, Hindi, Vietnamese, Lao and Indonesian. All participants are undertaking business and management related post-secondary degrees in Swinburne University of Technology.

In question 6, students were asked if they had learnt any reading strategies (e.g. summarising, paraphrasing, predicting, visualising and making connections) before they commenced their study in Australia. Nearly 60% participants answered positively, while others gave a negative answer. Amongst students who had learnt cognitive strategies before they came to Australia, 76% indicated they have learnt summarising, 64% had learnt paraphrasing, 45% had learnt
predicting, 42% had learnt visualising and 52% had learnt making connections.

Question 7 asked if students often read hypertexts. Almost 52% of participants admitted that they often read hypertexts in their daily lives. Sixty-six percent of participants who read hypertexts frequently indicated that they prefer reading hypertexts. They commented that reading online allows them to obtain large amounts of information in a relatively short period of time. Moreover, online search functions and hyperlinks also enable them to reach information in a swift manner. On the other hand, those who preferred reading conventional print-based texts commented that they feel reading really occurs when they hold texts in their hand and turn pages of a hard-copy book. In addition, these participants indicated that they are able to take notes on print-based texts and/or write brief summaries as they read. These notes and/or summaries serve as reminders when reviewing what they had read.

Question 8 asked which cognitive strategies they had used when reading hypertexts in the experiment. Sixty-six percent of participants applied the summarising strategy, 36% used paraphrasing, 27% used predicting, 30% used visualising and 44% employed making connections in the experiment. Figure 6.8 shows frequencies of cognitive strategies use by NESB students in the experiment.
Figure 6.8 indicates that summarising is the most preferred cognitive strategy amongst NESB participants while reading online. Making connections is the second most preferred cognitive strategy chosen by participants, followed by paraphrasing, predicting and visualising.

Students were also asked which metacognitive strategies they had used while reading hypertexts. In this particular question, metacognitive strategies instructed in this research were condensed into four steps: planning, monitoring, evaluating and reviewing. Thirty-Two percent of students used planning, 20% used monitoring, 30% used evaluating and 66% used reviewing. Figure 6.9 displays frequencies of various metacognitive strategies use by NESB participants in the experiment.
Figure 6.9 shows that the reviewing strategy was used by more than 65% participants in this study, followed by planning. Evaluating was used by 30% of participants and monitoring was employed by 20% of participants.

Finally students were asked if the training had helped them improve their reading comprehension. 96.4% of participants agreed that training had improved their reading comprehension. Moreover, 96.4% of all students believed they would use strategies taught in this research in the future when they read hypertexts.

6.6 Concluding remarks

This chapter has presented the analysis of the experimental data. In order to test if Hypothesis 1 was supported, a 2(stages) x 2(structures) analysis of variance (ANOVA) and paired-samples t-tests were conducted. Results of these tests have revealed that the difference between the pre- and the post-test for NESB students who read linearly and hierarchically structured hypertexts was significant. Thus, it can be concluded that the training on reading comprehension strategies had an influence on enhancing NESB students’ hypertext
comprehension performance. Hypothesis 2 was tested by a 2(structures) x 2(stages) and two sample t-tests. Results indicated that NESB students who read linearly structured hypertext outperformed those who read hierarchically structured hypertexts, in the pre- and the post-tests. Therefore, it can be concluded that hypertexts structures had an influence on NESB students’ hypertext comprehension results. Students who read linearly structured hypertexts tend to comprehend hypertexts better than those who read hierarchically structured hypertexts. Students were asked to complete a post-test questionnaire. Amongst all metacognitive strategies instructed in the research, reviewing is the most frequently used strategy utilised by participants. More than 95% of participants considered reading comprehension strategies taught in the research were useful, and believed they would use these strategies while reading online in the future.
Chapter 7
Discussion

Chapter 6 has presented and discussed the results of data analysis. The results presented in Chapter 6 revealed that NESB students’ hypertext comprehension performance is significantly improved after they receive reading strategy training (refer to Section 6.3). Also, the results confirmed that linearly structured hypertexts were more appropriate for educational purposes than hierarchically structured hypertexts (refer to Section 6.4). In this chapter, results of the present study are linked and discussed in relation to previous studies. First, a brief overview of the hypotheses and results of the present study is provided. Secondly, the influence of a reading strategy training program on NESB students’ hypertext comprehension performance is discussed, based on the comparison and contrast of results of the present study, and conclusions made by prior studies. Thirdly, results of the present study are also linked to previous conclusions, which address the impact of hypertext structures on NESB students’ hypertext comprehension. Lastly, students’ attitude to, and perception of, reading online materials and using strategies are also compared with prior studies.

7.1 An overview of research hypotheses and results of the present study

The aims of the present study (refer to Section 5.2) are to explore the influence of reading strategy training on NESB students’ hypertext comprehension performance, and detect the effect of different hypertext structures on NESB students’ hypertext comprehension results. Therefore, in the present study, it was hypothesised that NESB students’ hypertext comprehension performance would be greater after reading comprehension strategy training when they read linearly structured and hierarchically structured hypertexts. It was also
hypothesised that NESB students’ who read linearly structured hypertexts would outperform those students who read hierarchically structured hypertexts, both before and after reading comprehension strategy training (refer to Section 5.3).

In order to test the validity of hypotheses, quantitative data was collected from the experiment, where a pre- and post-test design was employed (refer to Section 5.5). There were two experimental groups: one group read linearly structured hypertexts and the other read hierarchically structured hypertexts. In the pre-test, NESB participants in both groups were required to complete hypertext comprehension tasks without being given any specific training. A reading comprehension strategy training program was carried out after the pre-test and consisted of five one-hour training sessions. NESB participants in both groups were taught cognitive strategies, metacognitive strategies and hypertext reading comprehension strategies. Also, they were asked to complete hypertext comprehension exercises during training sessions. Students were tested under the same conditions for both the pre-test and the post-test.

Results of data analysis indicated that hypertext comprehension performance by both experimental groups significantly improved after they received reading comprehension strategy training (refer to Section 5.7). In addition, as predicted, participants who read linearly structured hypertexts outperformed those who read hierarchically structured hypertexts in both the pre- and post-tests. Further, more than 50% of participants read hypertexts on a daily basis in their daily lives and personal study experiences. More than 95% of participants admitted that the reading comprehension strategy training enhanced their hypertext comprehension performance. In this chapter, connections between results in the present study and previous ones will be drawn. This chapter also differentiates the present study from prior studies on similar topics.

Section 7.2 elaborates connections between the present study and prior studies
in terms of the effects of reading comprehension strategy training on students’ hypertext comprehension performance. Section 7.3 discusses nexuses between the current results and previous conclusions in terms of the impacts of hypertext structures on students’ comprehension of hypertexts.

7.2 The influence of reading comprehension strategy training

The core of the present study is to investigate the effect of a reading comprehension strategy training program on the performance outcome of NESB students’ hypertext comprehension outcome. It has been highlighted by prior studies that effective reading comprehension strategy instruction can lead to the improvement of students’ (hypertexts) reading comprehension performance. For instance, Wilson (2011) argues that it is essential for students to become metacognitive via appropriately designed strategy instructions. Wilson (2011) also provides a guideline to design metacognitive strategy instructions. Both Anderson (2003) and Konishi (2003) emphasise the importance of teaching students from non-English speaking backgrounds to apply various reading comprehension strategies effectively. It is essential to teach NESB students undertaking post-secondary degrees to comprehend texts (including conventional print-based texts and hypertexts) metacognitively. However, neither Anderson (2003) nor Konishi (2003) recommended effective instructional principles to teach NESB students reading comprehension strategies. In this respect, the present study followed Duffy’s (2002) principles of reading comprehension strategies, in order to test the validity of such principles for teaching students from non-English speaking backgrounds (refer to Section 5.7). In addition, Merrill’s (2002) First Principle of Instruction was utilised as a guideline for the overall design and delivery of the training program in the present study (refer to Section 5.7).

Munro and Verezub (2011) conducted a study to explore the influence of reading
comprehension instruction on elementary students’ hypertext comprehension performance. This study had a pre- and post-test design with three strategy-training sessions. Students received three training sessions in their ordinary class time on a weekly basis, where they were taught three cognitive comprehension strategies: summarising, paraphrasing and predicting. Linearly structured hypertexts were used in Munro and Verezub’s (2011) study. The results of Munro and Verezub’s (2011) study indicate that elementary students’ hypertext comprehension performance improved significantly after reading comprehension strategy training sessions. This result remarks the importance of providing explicit reading comprehension strategy instruction to students, in order to improve their hypertext comprehension performance. In comparison with the results of the present study, both studies have highlighted that reading comprehension strategy training can result in improved outcomes for students’ hypertext reading comprehension.

However, Munro and Verezub’s (2011) training program was designed for elementary students, while the training program in the present study was prepared for post-secondary students who come from non-English speaking backgrounds. In this regard, the results of the current study suggest that reading comprehension strategies should be taught to students at all educational levels, in order to help students to comprehend hypertexts effectively.

Furthermore, only linearly structured hypertexts were used in Munron and Verezub’s (2011) study; in contrast, hypertexts with linear and hierarchical structures were used in the present study. Thus, the present study emphasises that reading comprehension strategy training can lead to increased comprehension performance, when students read hypertexts with different structures.

In addition, only cognitive strategies were taught to participants in Munro and
Verezub’s (2011) study; metacognitive strategies, cognitive strategies and hypertext reading comprehension strategies were included in the training program of the present study. It highlights that students at vocational and higher education levels should be taught strategies that enable them to regulate and control their comprehension of hypertexts. While three training sessions were delivered to participants in Munro and Verezub’s (2011) study, participants in the current study received five one-hour training sessions. This difference suggests that the length of training sessions should be determined by the complexity of hypertext content, the number and types of strategies taught to students, and students’ current educational levels.

Verezub et al. (2008) carried out a research project in order to explore the relationship between a metacognitive strategy training program, and TAFE students’ hypertext comprehension performance. This project included a pre-test, a post-test and three 1.5-hour training sessions. Participants were asked to comprehend linearly structured hypertexts with text links, picture links and audio links. Metacognitive strategies taught to participants in Verezub et al.’s (2008) study followed Parlinscar and Brown’s (1989) framework. Duffy’s (2002) instruction principles of reading comprehension strategies were used as guidelines for training sessions in Verezub et al.’s (2008) study. In both pre- and post-tests, participants were asked to comprehend hypertexts with five links. The results of this project confirm the influence of metacognitive strategy training programs on TAFE students’ improvement in hypertext comprehension performance.

Verezub et al.’s (2008) results are similar to results of the present study. The present study also used Parlinscar and Brown’s (1989) framework and Duff’s (2002) principles in training sessions. Participants in the present study were also undertaking post-secondary degrees. In addition, literal, inferential and critical comprehension questions were used in both studies. However, differences exist
between Verezub et al.’s (2008) study and the present study. First, three types of link contents (i.e. text links, picture links and audio links) were involved in Verezub et al.’s (2008) study; only text links were used in the present study. In this regard, hypertexts used in Verezub et al.’s (2008) study can put more demand on participants’ working memory than those hypertexts used in the present study, since Verezub et al.’s (2008) participants needed to listen to audio clips, while comprehending online written texts. The reasons for excluding multimedia content in the present study will be explained in Chapter 8. Secondly, Verezub et al. (2008) required students to comprehend hypertexts with five links in both pre- and post-test conditions; participants in the present study were required to comprehend hypertexts with nine links. Thirdly, only a linear structure was used to organise hypertexts in Verezub et al.’s (2008) study; hypertexts with both linear structures and hierarchical structures were included in the present study. Moreover, Verezub et al. (2008) recruited one experimental group, where participants were asked to read hypertexts with three different types of links; the present study contained two experimental groups, one of which read hypertexts with linear structures, while the other one read hypertexts with hierarchical structures. Furthermore, Verezub et al. (2008) provided three 1.5-hour training sessions on a weekly basis; participants in the current study received five one-hour training sessions per week. Lastly, Verezub et al. (2008) recruited TAFE students’ only, while participants in the present study were NESB students undertaking TAFE, Unilink programs and undergraduate degrees.

Azevedo and his research fellows carried out a number of studies related to applying metacognition in the context of learning with hypermedia. Some of these studies included training sessions in their research design. For instance, Moos and Azevedo (2008) conducted a study to detect the influence of students’ prior knowledge on their application of self-regulation (part of metacognition), while learning with hypermedia. This study had a pre-and-post-test design, with a short training session between the pre- and post-test. Students received the pre-test,
the training session and the post-test in sequence, within the same day. However, 
the training session included in this study was not related to teaching students to 
apply metacognitive strategies, since the study (Moos & Azevedo 2008) did not 
focus on exploring the relationship between a training program and students’ 
hypermedia learning outcome. The purpose of providing the training session was 
to enable participants to familiarise themselves with the hypermedia system used 
in this study (Moos & Azevedo 2008). The training program in the present study 
was designed to teach NESB students various reading comprehension strategies, 
which allow them to comprehend hypertexts effectively. However, participants 
were still able to familiarise themselves with the hypertext system used in the 
present study via hypertext comprehension exercises involved in training 
sessions.

Another study accomplished by Azevedo and Cromley (2004) concluded that 
metacognitive strategy-training programs could lead to the enhancement of 
students’ hypertext/hypermedia learning outcome. There were two groups of 
participants in this study, an experimental group and a control group. Both groups 
had the pre-test at the same time. However, only the experimental group received 
a 30-minute metacognitive strategy-training session. Strategies taught in the 
class include planning, monitoring and evaluating. The two groups were given the 
post-test after the instruction to the experimental group was complete. As a result 
of receiving the metacognitive strategy instruction, the experimental group 
outperformed the control group in the post-test.

The major similarity between the present study and Azevedo and Cromley’s 
(2004) study is that both studies consolidate the fact that effective reading 
comprehension strategy training can result in the improvement of students’ 
learning outcome with hypertexts/hypermedia. On the other hand, there are a 
number of differences between the two studies. First, the training program in the 
present study contained five one-hour training sessions delivered to participants
on a weekly basis; there was only one 30-minute training session between the pre- and post-tests in Azevedo and Cromley’s (2004) study. To some extent, it would be difficult to argue the long term effect of the strategy training program offered by Azevedo and Cromley (2004), considering the length of the training. Secondly, the present study used text-only hypertext materials; Azevedo and Cromley (2004) included multimedia content (audio and video content) in their study. In this regard, participants’ listening comprehension skills can also have an impact on the results in the study (Azevedo and Cromley 2004). Thirdly, participants in the present study came from non-English speaking backgrounds; Azevedo and Cromley (2004) did not specify their participants’ language and cultural backgrounds. Lastly, participants were assigned into two experimental groups, where all participants received the reading comprehension strategy training program in the present study, while Azevedo and Cromley (2004) recruited a control group, participants of which did not receive any relevant instruction.

McNamara (2004) developed a metacognitive strategy training mechanism called Self-Explanation Reading Training (SERT). SERT aims at improving students’ hypertext reading comprehension performance, in light of metacognition. Strategies taught to students in SERT include comprehension monitoring, predicting, paraphrasing, elaborating and bridging. McNamara organised an experiment to test the effectiveness of SERT. Participants in the experimental group were taught the above strategies in two training sessions, followed by hypertext comprehension exercises. The results of this experiment indicated that participants who received the SERT training outperformed those who did not receive the training. It concluded that SERT could result in an increase of students’ reading comprehension. Most strategies included in SERT are taught in the present study, and the overall research design of McNamara’s (2004) study is similar to the present study. Also, McNamara’s (2004) conclusion supports the results of the present study.
The differences between McNamara’s (2004) study and the present study lie in the number of training sessions included in the program, cohorts of participants, as well as hypertext structures. First, the present study contained five one-hour training sessions, where participants were taught metacognitive strategies, cognitive strategies and hypertext comprehension strategies; in McNamara’s (2004) study participants were taught metacognitive strategies and cognitive strategies in two 75-120minute training sessions. Secondly, the present study recruited participants who come from non-English speaking backgrounds only; McNamara (2004) did not specify participants’ cultural and language backgrounds. Thirdly, the present study employed both linearly structured and hierarchically structures; only linearly structured hypertexts were used in McNamara’s (2004) SERT study.

Wichadee (2011) carried out a study to explore the influence of metacognitive strategy instructions on NESB students specifically. This study was implemented in an ordinary university class setting, with 40 Thai participants taking part. There were 14 sessions delivered to participants on a weekly basis, including a pre-test (session 1) and a post-test (session 14). Each session lasted for approximately 45 minutes. Participants were taught metacognitive strategies based on Wade, Trathen and Schraw’s (1990) theory (for detail, refer to Section 4.5 in Chapter 4). Also, they were required to complete paper-based reading comprehension exercises in instructional sessions. Results of this study indicated that teaching post-secondary NESB students to read metacognitively could increase their reading comprehension performance substantially. Another conclusion was that metacognitive strategy instruction increases the number and frequency of strategies used by NESB students.

Wichadee’s (2011) study has a number of similarities with the present study. First, pre- and post-tests were both included in both studies. Secondly, participants
were given training sessions on a weekly basis. Thirdly, both studies recruited participants only from non-English speaking backgrounds. Furthermore, both studies explored the long-term influence of metacognitive instructions on NESB students’ improvement in comprehension, and participants were asked to accomplish reading comprehension exercises in each training session. In this study it was found that participants’ comprehension performance was significantly enhanced after the training program. This is why Wichadee (2011) argued that metacognitive strategy instructions could make deficient readers become proficient. In this sense, the present study is consistent with Wichadee’s (2011) research findings, which conclude that metacognitive strategy training can assist NESB students to improve their reading comprehension performance.

There are a number of differences between the present study and Wichadee’s (2011) study. First, the teaching methodologies used in these two studies are different. The present study used Parlinscar and Brown’s (1989) framework in conjunction with Duffy’s (2002) and Merrill’s (2002) instructional principles; Wichadee (2011) used Wade et al.’s (1990) model of metacognitive strategies. In terms of teaching methodologies, the present study focused on both the delivery of strategies and the overall design of instruction procedures. By contrast, Wichadee (2011) concentrated on teaching selected strategies; however, instructional principles for such strategies were not specified. Secondly, NESB participants in the present study came from diverse language and cultural backgrounds; Wichadee (2011) recruited Thai post-secondary participants only. However, the results of these two studies confirmed that it is of great importance to teach reading comprehension strategies to post-secondary NESB students explicitly, to enhance their understanding of learning materials. Thirdly, in the present study, participants’ comprehension performance was tested in the context of comprehending hypertexts; in Wichadee’s (2011) study, comprehension was examined in terms of reading paper-based texts. Thus, reading comprehension strategy training is crucial for NESB students to enhance
their reading comprehension performance, in both the conventional written-text and hypertext contexts. In addition, the present study obtained NESB participants’ attitude to, and perception of, strategies used via a post-test questionnaire; Wichadee (2011) selected a number of participants (i.e. proficient readers and deficient readers) to take part in a semi-structured interview. Lastly, there were five one-hour training sessions included in the present study, whereas twelve 45-minute training sessions were delivered to participants by Wichadee (2011). In other words, participants in Wichadee’s (2011) study received their training throughout a semester. Therefore, Wichadee (2011) embedded the reading comprehension strategy training program into a mainstream subject, and used the program as a teaching tool for the subject. In the present study, the reading comprehension strategy training was delivered as part of the additional program offered to NESB students.

In fact, previous studies do suggest that online reading comprehension strategy instruction can be effective in enhancing NESB participants’ reading comprehension skills. For instance, Shen and Liu (2011) completed a study to test the effectiveness of a web-based metacognitive strategy training program for NESB students. They taught four metacognitive strategies (i.e. planning, monitoring, modifying and evaluating) to participants via four online training sessions. Participants were asked to accomplish different learning tasks in each session. This experiment included a pre- and a post-test. Also, there was a control group, where participants only took part in the pre- and post-tests. The results of this study suggest that online metacognitive strategy training can result in an increase in students’ ability to plan and monitor. However, their ability to modify strategies and evaluate their learning processes was not enhanced significantly.

To some extent, Shen and Liu’s (2011) conclusions support the research finding of the present study. First, Shen and Liu’s (2011) study confirmed the
effectiveness of reading comprehension strategy training in improving NESB students’ application of reading strategies. Secondly, it also emphasised the importance of including adequate exercises for students to apply strategies.

However, there are differences between the present study and Shen and Liu’s (2011) study. First, in the present study face-to-face instructions were given to participants; Shen and Liu (2011) provided online instructions, which were delivered to students via a specifically designed website. Face-to-face instructions allow participants to receive supervision and support from teachers in a timely manner, whereas online instructions enable the training program to reach more participants than conventional approaches. However, it should be noted that online students might not be able to obtain prompt assistance from teachers. Secondly, participants in the present study were also taught cognitive strategies and hypertext comprehension strategies; Shen and Liu (2011) taught only four metacognitive strategies to participants. In this regard, the present study taught participants to comprehend hypertexts using metacognitive strategies that helped students to control and regulate their hypertext reading processes; cognitive strategies that allowed students to acquire a basic understanding of hypertexts, and establish various mental representations of what they read; and hypertext comprehension strategies that guided students to connect nodes appropriately. Thirdly, strategies taught in the present study were repeated to participants in each training session; Shen and Liu (2011) taught one particular metacognitive strategy per session. In this case, Shen and Liu’s (2011) participants may not be given opportunities to apply all strategies collaboratively in training sessions. Moreover, Shen and Liu (2011) admitted that the design of their online training program was not sophisticated. The training for comprehension monitoring was not sufficient at the current stage. The limitations of Shen and Liu’s (2011) study remarked the importance of careful planning and design while delivering reading comprehension strategy training interventions to students. In particular, coaching students in the e-learning environment requires
more sophisticated planning and design than in a face-to-face instructional context, since students may not be able to get adequate and timely supervision or feedback from their teachers, when they have questions in the e-learning context.

Sung et al.’s (2008) conclusion on the effects of reading comprehension strategy also supports the results of the present study. Sung et al. (2008) employed a computer-based reading comprehension strategy-training tool to teach elementary students cognitive strategies in Traditional Chinese. They randomly assigned 65 participants to the experimental group, and 65 to the control group. The experimental group was given an 11-week reading comprehension strategy training that contained 22 training sessions via computers. The results of this study proved that reading comprehension strategy training contributed to the increase of students’ frequency of strategy application, and improvement in hypertext comprehension performance.

Although conducted in a Chinese-speaking environment, Sung et al.’s (2008) study still shares some similarities with the present study. First, both studies contained training sessions with hypertext comprehension exercises. Secondly, both studies stressed the importance of reading comprehension strategy training.

However, Sung et al. (2008) used a computer-based instructional approach, while the present study used a traditional face-to-face one. The success of Sung et al.’s (2008) study suggests that the teaching methodology of the present study can be implemented in the online teaching context in the future. In terms of participants, Sung et al. (2008) recruited Taiwanese elementary students to comprehend hypertexts written in Traditional Chinese; the present study recruited students from non-English speaking backgrounds to read hypertexts written in English. It implies that reading comprehension strategy training is important for students to comprehend texts written in all languages. Only cognitive strategies were taught in Sung et al.’s (2008) study; metacognitive
strategies, cognitive strategies and hypertext comprehension strategies were taught to participants in the present study. Given participants were asked to read hypertexts in Sung et al.’s (2008) study, hypertext reading comprehension strategies should also be taught to participants. Sung et al.’s (2008) study provided longer sessions than the present study. Furthermore, there was a control group in Sung et al.’s (2008) study, whereas, no control group was used in the present study.

Aside from the above two studies, computerised metacognitive strategy-training interventions (Such as iSTART) have proved to be effective in enhancing students’ hypertext comprehension performance (Magiliano et al 2005; McNamara et al. 2007). However, the training program in the present study was delivered to participants in the conventional face-to-face approach. There are a number of reasons for this decision. First, face-to-face, or live, instructions can maintain students’ participation in classes. Secondly, NESB students’ questions about instructional materials can get resolved in a timely manner. Thirdly, students’ interactions and communication with peer students and the teacher can be strengthened. The above reasons will be elaborated in Chapter 8.

7.2.1 Concluding remarks of the section
This section has discussed the influence of a reading comprehension strategy training program on students’ hypertext comprehension performance, by comparing and contrasting the results of the present study with previous ones. The results of the present study indicate that the reading comprehension strategy training program has improved NESB students’ hypertext comprehension performance significantly. It is supported by a number of prior studies. The comparison and contrast discussed in this section are concluded from the following perspectives:

- Participants;
Participants. The present study recruited post-secondary students who come from non-English speaking backgrounds, and investigated the influence of reading comprehension strategy training on the improvement of their hypertext comprehension. Amongst relevant previous studies, Verezub et al. (2008), Wichadee (2011) and Shen and Liu (2011) employed NESB participants undertaking post-secondary degrees to take part in their studies. Azevedo and Cromley (2004) recruited undergraduate students to participate their study; however, they did not specify cultural and language backgrounds of their participants. McNamara (2004), Sung et al. (2008) and Munro and Verezub (2011) used elementary students as their participants. In particular, McNamara’s (2004) and Munro and Verezub’s (2011) participants, were native English speakers; Sung et al.’s (2008) participants’ mother tongue was Chinese. Therefore, it can be argued that reading comprehension strategy training is crucial for students at all levels of education, with different cultural and language backgrounds.

Experiment design. The present study had a pre-and-post-test design, and delivered over five one-hour face-to-face sessions on a weekly basis. Participants were assigned into two experimental groups, one of which comprehended linearly structured hypertexts, and the other hierarchically structured hypertexts. Participants were required to complete hypertext comprehension exercises in training sessions. All relevant prior studies mentioned in this section included pre- and post-tests. Verezub et al. (2008) used a similar experimental design as the present study. However, they did not assign participants into different experimental groups. All of their participants were asked to comprehend hypertexts with three different types of links in the same group.
(Verezub et al. 2008). Three one-and-half-hour metacognitive strategy training sessions were delivered to participants in Verezub et al.’s (2008) study on a weekly basis.

Munro and Verezub (2011) taught cognitive strategies to elementary students in their ordinary class time. There were three training sessions included in Munro and Verezub’s (2011) study, in each of which participants were taught one cognitive strategy on a face-to-face basis. Two experimental groups were recruited, including a group of Grade Three primary school students and a group of Grade Six students.

Azevedo and Cromley (2004) recruited a control group and an experimental group to compare the influence of a metacognitive strategy-training instruction. They provided the experimental group a 30-minute training session before the post-test. The instruction was conducted in a conventional face-to-face approach. In particular, the length of the training session was the shortest amongst all relevant previous studies. In this respect, it is difficult to argue Azevedo and Cromley’s (2004) training would generate long-term effects on students’ hypermedia comprehension performance.

McNamara (2004) also included a control group in her study. She gave participants two reading comprehension strategy-training sessions, each of which lasted for 75-120 minutes. The traditional face-to-face instructional approach was also used in McNamara’s (2004) study.

Wichadee (2011) provided 12 metacognitive strategy-training sessions to participants throughout a semester. Each training session was run for approximately 45 minutes. Since the training program was incorporated with a
mainstream subject, Wichadee (2011) used the conventional face-to-face approach to deliver all training sessions.

Shen and Liu (2011) delivered their metacognitive strategy training in an online environment. There were four online training sessions delivered to the experimental group, while the control group did not receive any training. Participants in the experimental group were taught one metacognitive strategy per session.

Sung et al. (2008) used computer-based reading comprehension strategy-training software to teach cognitive strategies. They also involved a control group in their study. There were 22 training sessions delivered to participants, which was the longest training period amongst all relevant studies mentioned in this section.

Language used in the study. The present study was implemented in the English speaking country with all materials and information written in English. Amongst prior studies discussed in this section, Wichadee (2011) and Shen and Liu (2011) conducted their studies in non-English speaking countries and taught NESB students to apply metacognitive strategies in English. Sung et al. (2008) taught cognitive strategies to Chinese students in Taiwan, with all learning materials written in Traditional Chinese. Other relevant studies mentioned were all carried out in English speaking countries, and used English as the instructional language.

Types of texts used in the study. The present study used hypertexts with either linear or hierarchical structures. All information included in the hypertexts used in the present study was written text with no multimedia content. Munro and Verezub (2011) and McNamara (2004) used purely written text in the hypertexts
in their studies. However, they only employed a linear structure to organise their hypertexts.

Verezub et al. (2008) also employed linearly structured hypertexts in their study. Multimedia content such as pictures, audio clips and video clips was used in their study. Azevedo and Cromley’s (2004) study also used linearly structured hypermedia. In this respect, participants’ listening comprehension skills can play an essential role while testing participants’ comprehension performance.

Wichadee (2011) used conventional print-based texts in the study to test participants’ improvement in reading comprehension performance. In addition, in computer-based programs designed by Shen and Liu (2011) and Sung et al. (2008), participants received information in linear sequences. Comparing with all relevant studies discussed in this section, the present study compared the influence of a reading comprehension strategy training program on participants’ hypertext comprehension performance using two different structures.

Strategies taught in the program. The present study taught cognitive strategies, metacognitive strategies and hypertext comprehension strategies to participants. The overall instruction design and strategy delivery followed Merrill’s (2002) and Duffys’ (2002) principles and guidelines. Both Munro and Verezub (2011) and Verezub et al. (2008) employed Duffy’s (2002) guidelines to deliver their reading comprehension strategy training. However, Munro and Verezub (2001) taught participants how to apply cognitive strategies, whereas Verezub et al. (2008) taught metacognitive strategies to participants.

Azevedo and Cromley (2004) taught self-regulated strategies (part of metacognitive strategies) to participants. They did not mention instructional principles used in their training session. In McNamara’s (2004) study, the combination of cognitive strategies and metacognitive strategies in the reading
comprehension strategy instructional intervention called SERT were used.

In Wichadee’s (2011) study, metacognitive strategies were taught to students. Shen and Liu (2011) delivered the metacognitive strategy training in the online environment. Sung et al. (2008) taught cognitive strategies to participants via a computer-based teaching tool. However, none of these studies specified instructional principles in their training programs.

The present study also aims at exploring the influence of different hypertext structures on NESB students’ hypertext comprehension performance. The following section discusses results of the present study in terms of the effects of different hypertext structures, and draws inferences between the present study and conclusions made by prior studies.

7.3 The influence of two types of hypertext structures

In terms of the effect of hypertext structures on NESB students’ comprehension performance, the results of the present study are consistent with McDonald and Stevenson’s (1996;1998) conclusions; that is, linearly structured hypertexts can lead to a student’s better understanding of hypertexts than hierarchically structured hypertexts. However, McDonald and Stevenson (1996; 1998) compared students’ navigation scores when they read hypertexts with three different structures; in the present study, two hypertext structures were employed. One experimental group of the current study read hypertexts with linear structure; the other group read hypertexts with hierarchical structure. McDonald and Stevenson (1996; 1998) simply compared students' hypertext navigation performance in a pre-test condition; however, neither relevant training sessions nor a post-test were included. In contrast, the present study tested students’ hypertext comprehension by using three different types of comprehension questions; also, students were taught relevant reading comprehension strategies.
In particular, a pre-test and a post-test were used in the experimental design of the present study, to compare students’ performance, before and after the training program. Participants in McDonald and Stevenson’s (1996;1998) studies were native English speakers; participants in the present study came from non-English speaking backgrounds. In addition, participants’ levels of system prior knowledge should be noted. With the advent of ICT, more and more contemporary students have access to computers and the Internet. The data collected from the post-test questionnaire of the present study indicates that participants in the present study read hypertexts frequently, and enjoy searching and linking functions of the Web. Furthermore, the hypertext system used in the present study was more advanced than the one used in McDonald and Stevenson’s (1996;1998) study.

The results of the present study contradict the conclusion made by Waniek, Brunstein, Naumann and Krems (2003). They recruited 48 undergraduate students majoring in psychology in Chemnitz University of Technology, Germany. Participants were assigned into three experimental groups, where hypertexts were organised differently. They provided three types of hypertexts: hypertexts with a linear structure, but without the structure overview; hypertexts with a linear structure, including the structure overview; and hypertexts with hierarchical structures, including the structure overview. Students’ understanding of hypertexts was measured by short summaries they wrote after they read the hypertexts. The results of this study revealed that students who read hierarchical structures with a structure overview, outperformed those who read linearly structured hypertexts, with or without a structure overview. Waniek et al. (2003) argues that this conclusion parallels previous conclusions that the non-linearity of hypertexts resembles human beings’ cognitive processes (Salmeron et al. 2006).

There are a number of possible reasons that lead to the contradictory results made by the current study and Waniek et al.’s (2003) study. First, hierarchically
structured hypertexts used in the present study did not include any structure overview, whereas a structure overview was provided in Waniek et al.’s (2003) study. The provision of a structure overview could reduce the demand on students’ working memory, as well as decrease possible disorientation. Secondly, NESB participants in the present study were required to comprehend hypertexts and complete comprehension tasks in English. Waniek et al. (2003) recruited their participants in a German University, but did not specify participants’ cultural and language backgrounds. In particular, they neither specified if hypertexts were written in English or German, nor whether participants were asked to write short summaries in English or their mother tongue.

Al-Seghayer’s (2005;2007) conclusions parallel the results of the current study. NESB participants in Al-Seghayer’s (2005;2007) study were asked to comprehend well-structured hypertexts and less well-structured hypertexts. Well-structured hypertexts were designed with a clear concept map, where participants were able to get interrelationships amongst all nodes. In particular, the structure overview displayed the interrelationship amongst the nodes. Less-structured hypertexts were designed without a structure overview; instead, there were only titles of each node on the left-hand side of the screen. Participants’ comprehension performance when reading well-structured hypertexts was significantly better than when less-structured hypertexts were read. That found support in NESB participants’ feedback, which stated they believed that they preferred reading well structured hypertexts.

Hypertext systems used in Al-Seghayer’s (2005;2007) study and the current study were different. Al-Seghayer (2005;2007) used a software called Flash MX as a platform to display the hypertexts; the present study used HTML, a common platform for displaying hypertexts nowadays. In addition, according to Oliver and Herrington’s (1995) definitions, hypertexts used in Al-Seghayer’s (2005;2007) study should be called linearly structured hypertexts, since participants continued
reading by clicking a “Previous” and a “Next” buttons. In this regard, sequences of nodes were pre-determined. In the present study, only linearly structured hypertexts had pre-defined sequences of nodes. Participants who read hierarchically structured hypertexts had a certain freedom of navigation.

In terms of the influence of hypertext structures on students’ learning outcome, the result of present study parallels Martin’s (2008) conclusions. Martin’s (2008) study explored the effects of online training on students’ online learning when they were interacting with linearly and non-linearly structured online learning programs. Martin (2008) randomly assigned 240 undergraduate participants into four experimental groups: learning with a linearly structured online learning program, with practice; learning with a linearly structured online learning program, without practice; learning with a non-linearly structured online learning program, with practice; learning with a non-linearly structured hypertexts, without practice. The results of the study revealed that participants who interacted with linearly structured online learning programs, with practice, outperformed participants in the three other experimental groups. In particular, those who learnt with non-linearly structured online learning programs, without practice, received lowest scores amongst the four experimental groups. These results confirmed that linearly structured online learning materials could lead to better performance by students.

There are a number of similarities between the present study and Martin’s (2008). First, both studies confirmed the advantage of linearly structured online learning materials for instructional and educational purposes. Secondly, participants were given opportunities to practise what they had learnt in an online environment. Thirdly, the content of online learning materials was incorporated into mainstream subjects.

In terms of differences between the present study and Martin’s (2008), the
primary difference lies in the participants. The present study recruited only students from non-English speaking backgrounds; Martin’s (2008) participants were native English speakers. The second difference lies in the experimental groups chosen in the two studies. There were two experimental groups in the present study, including a group that read linearly structured hypertexts, and a group that read hierarchically structures. All participants in the present study were given reading comprehension strategy training and hypertext comprehension exercises in training sessions. Martin (2008) assigned participants into four experimental groups: students from Group 1 interacted with a linearly structured online learning program, with practice; students in Group 2 interacted with a linearly structured online learning program, without practice; the third group interacted with a non-linearly structured online learning program, with practice; and the fourth group interacted with a non-linearly structured hypertexts, without practice. In other words, not all participants had chances to practise what they learnt.

Furthermore, hierarchically structured hypertexts used in the present study had limited numbers of links; thus, participants who read them were given limited freedom of navigation. Participants in the two experimental groups were taught hypertext comprehension strategies, based on Protopsaltis’s (2008) and Sutherland-Smith’s (2002) recommendations. Participants were taught strategies including making connections between nodes, identifying keywords in each link, and making sure of their current positions. In particular, they were taught how to apply hypertext comprehension strategies, in addition to cognitive and metacognitive strategies. The results of the present study indicate that various reading comprehension strategies taught in the present study were effective.

7.3.1 Concluding remarks of the section
Section 7.3 discusses the influence of hypertext structures on NESB students’ hypertext comprehension performance, and links research findings of the present
study to previous conclusions. The differences and similarities between this study and previous research are summarised from the following perspectives:

- Participants;
- The experiment design;
- Hypertext structures and hypertext systems;
- Conclusions.

Participants. The present study recruited post-secondary NESB participants to comprehend hypertexts with either linear or hierarchical structures. All relevant prior studies discussed in this section recruited post-secondary students to take part in their studies. In particular, Al-Seghayer’s (2005;2007) study employed participants who came from non-English speaking backgrounds. Waniek et al. (2003) conducted their study in a German University, but did not specify the language of instruction and cultural backgrounds of their participants. McDonald and Stevenson (1996;1998) and Martin (2008) recruited native English speakers in their studies.

The experimental design. The present study included two experimental groups to comprehend hypertexts with linear or hierarchical structures respectively. Pre- and post-tests were used to collect data. Moreover, participants in the present study received five one-hour reading comprehension strategy training sessions before they commenced their post-tests. McDonald and Steveson (1996; 1998) only compared participants’ navigation scores in a pre-test condition. Neither training sessions, nor post-tests, were conducted.

Waniek et al. (2003) assigned participants into three experimental groups to comprehend hypertexts with different structures. They used linearly structured hypertexts, without the structure overview; hypertexts with a linear structure, with the structure overview; and hypertexts with hierarchical structures, with the
structure overview. They measured participants’ hypertext comprehension performance by asking them to write short summaries of what they read. However, no post-test was used in Waniek et al.’s (2003) study.

Al-Seghayer’s (2005;2007) study did not include post-tests either. However, a 30-minute training session was given to participants before they commenced comprehending hypertexts, in order to familiarise them with the hypertext system. Well-structured and less well-structured hypertexts were used in Al-Seghayer’s (2005;2007) study. Participants were not assigned into different experimental groups.

Martin (2008) randomly assigned participants into four experimental groups, two of which were interacting with linearly structured online learning materials, with or without practices; others were interacting with non-linearly structured online learning materials, with or without practices. In other words, some participants did not get opportunities to apply what they had learnt. Furthermore, Martin (2008) did not use the pre-and-post-test design.

In general, post-tests were not used in relevant studies mentioned in this section. Although Al-Seghayer (2005;2007) provided a short training session to participants, this training session was not related to reading comprehension strategy training of any kind. Some participants in Martin’s (2008) study received practices that were relevant to their online learning materials, while others did not. This particular design was similar to hypertext reading comprehension exercises included in training sessions in the present study.

Hypertext structures and hypertext systems. The present study compared NESB participants’ comprehension performance while reading hypertexts with either linear or hierarchical structures. HTML was used as the platform to present
hypertexts. No navigational guidance or structure overviews were given to participants who comprehended hypertexts with hierarchically structured hypertexts. Of all relevant prior studies mentioned, McDonald and Stevenson (1996;1998) used similar hypertexts structures to the ones used in the present study. They utilised linearly, hierarchically and referentially structured hypertexts. They used Microsoft Explorer 4 to present hypertexts.

Wanick et al. (2003) designed their hypertexts in three different ways: linearly structured hypertexts, with the structure overview, linearly structured hypertexts, without the structure overview, and hierarchically structured hypertexts, with the structure overview. The hypertext system used in their study was similar to the present study.

Al-Seghayer’s (2005;2007) study used a system called Flash MX to display well-structured and less well-structured hypertexts, where participants needed to click on “Previous” and “Next” buttons to proceed through the hypertexts. Martin (2008) delivered the online learning program via software called “Dreamweaver”. Martin (2008) compared participants’ learning outcome when they were interacting with linearly structured and non-linearly structured online learning materials.

To sum up, hypertext systems used in relevant studies vary from one to another due to the purposes of different studies, and the technology available when studies were conducted.

Conclusions. Results of the present study indicate that linearly structured hypertexts can lead to better comprehension performance than hierarchically structured hypertexts. This research finding is supported by McDonald and Stevenson’s (1996;1998), Al-Seghayer’s (2005;2007) and Martin’s (2008) conclusions. However, it contradicts Waniek et al.’s (2003) conclusion, which
stated hierarchically structured hypertexts, with the structure overview, would produce better comprehension performance than linearly structured hypertexts. This contradiction could happen due to the provision of the structure overview, which can reduce the demand on participants’ working memory. Waniek et al. (2003) did not specify participants’ language and cultural backgrounds, nor clarify whether hypertexts used in their study were written in English or German.

To sum up, the present study compared participants’ reading comprehension performance when comprehending hypertexts with linear or hierarchical structures, before and after reading comprehension strategy training. The present study taught cognitive strategies, metacognitive strategies and hypertext comprehension strategies to participants. This seldom happened in prior studies discussed in this section.

The present study also surveyed participants in terms of their perception of reading hypertexts, and applying various reading comprehension strategies. The next section discusses relevant results, and links present results to conclusions of previous studies.

7.4 NESB students’ attitude to strategy applications and hypertext reading experiences

The post-test questionnaire of the current study asked students to express their attitude to the use of various reading comprehension strategies and their hypertext reading experience. Participants were asked if they had learnt any reading comprehension strategies before they started their study in Australia. Also, participants had to identify strategies they used when comprehending hypertexts. They were required to identify the type of texts they preferred to read (i.e. conventional print-based texts or hypertexts). Furthermore, participants were also encouraged to express their perceptions of the type of text (either
conventional print-based texts or hypertexts) they preferred reading.

7.4.1 Participants’ prior knowledge of reading comprehension strategies
In the present study, nearly 60% of participants claimed that they had learnt cognitive reading comprehension strategies before they commenced their study in Australia. This figure parallels Lawrence’s (2007) argument that some students from non-English speaking backgrounds have learnt cognitive reading comprehension strategies at some stage. However, they may have difficulties naming those strategies in English. On the one hand, metacognitive strategies may not be taught to students from non-English speaking backgrounds in their countries of origin (Lawrence 2007). Therefore, participants were taught metacognitive strategies specifically in order to enhance their performance in comprehending hypertexts. On the other hand, a number of cognitive strategies were included in the training program, so as to refresh the memories of those who had learnt cognitive strategies in their countries of origin, and teach those who had not learnt such strategies before they continued their education in Australia.

7.4.2 Participants’ applications of cognitive strategies
Amongst five cognitive strategies (summarising, paraphrasing, predicting, visualising, making connections) participants were taught in the present study, summarising is the most popular strategy used by participants, followed by making connections, paraphrasing, visualising and predicting. These cognitive strategies belong to two clusters, known as organisation strategies and elaboration strategies (van Dijk & Kintsch 1983). According to Naumann et al. (2008), hypertext readers apply organisation strategies (i.e. paraphrasing and summarising in the present study) in order to understand relationships between nodes and links; whereas elaboration strategies (i.e. predicting, making connections and visualising in the present study) are used by readers to build different levels of mental representations. Participants of the present study used summarising, making connections and paraphrasing more frequently than
visualising and predicting, which can be attributed to the three types of comprehension questions used in the present study to measure participants’ comprehension.

The present study employed literal, inferential and critical questions to measure participants’ comprehension of hypertexts. Literal questions require participants to figure out answers, which are stated explicitly in hypertexts. In order to answer inferential questions correctly, participants need to connect content in different nodes and sections to each other. Critical questions evoke participants’ prior knowledge, and ask them to link their prior study to what they read from hypertexts. In this respect, summarising and paraphrasing can assist participants in answering literal questions and inferential questions; whereas making connections can help them complete inferential questions and critical questions. Another explanation could come from Munro and Verezub’s (2011) conclusion. They argue that students in higher grade levels tend to apply the summarising strategy more frequently and effectively than those who are in lower grade levels, because students in higher grade levels obtain more prior knowledge of selected topics and linguistic knowledge than those who are in lower grade levels. Participants in the present study are undertaking post-secondary degrees. They have adequate prior knowledge of given topics, which enables them to apply the summarising strategy effectively, to complete comprehension tasks.

7.4.3 Participants’ applications of metacognitive strategies
Amongst metacognitive strategies taught to participants in the present study, reviewing is the most frequently used strategy by participants, followed by planning, evaluating and monitoring. In training sessions, participants were taught to check their text comprehension as they read. If comprehension failed, participants had to repair their comprehension by applying more appropriate strategies for this situation. In this sense, reviewing allows participants to correct their mistakes and adjust their strategy applications.
The reading comprehension strategy training program in this study followed Merrill's (2002) ‘task-centred’ principles of instructions. Thus, participants were taught to focus on tasks they were required to accomplish throughout the training program. The planning strategy enables participants to have a clear overview of comprehension tasks they were asked to complete, and implement various strategies based on their comprehension tasks. The evaluating and monitoring strategies lead participants to assess how much prior knowledge they used while reading hypertexts, and to control their strategy applications. In this respect, participants used these two strategies to direct the establishment of mental representations of hypertexts. This result is in line with conclusions made by Konishi (2003).

However, it should be noted, conclusions made about NESB students’ attitude to and perceptions of using metacognitive strategies vary from study to study. This may be due to participants’ levels of prior knowledge and their levels of English language. It could also be caused by different research methods used in relevant studies. Researchers, such as Anderson (2003) and Konishi (2003), did not teach NESB students to use any strategies. Instead, they collected data based on questionnaires or think-aloud protocols, and there were six participants in Konishi’s (2003) study. The present study employed 49 participants in total (i.e. 24 participants comprehended linearly structured hypertexts and 25 participants comprehended hierarchically structured hypertexts). They were taught cognitive strategies, metacognitive strategies and hypertext comprehension strategies explicitly. Further, the influence of the reading comprehension strategy training was evaluated by the analysis of quantitative data collected from pre- and post-tests. In the present study, the post-test questionnaire was supplementary to the quantitative results.
7.4.4 Participants’ perceptions of reading hypertexts

Fifty-two percent of participants in the present study admitted that they read hypertexts frequently. Most of them claimed that they preferred reading hypertexts. Some participants who preferred reading hypertexts commented that they enjoyed the search functions of the Web, which allowed them to have swift access to a large amount of information. It parallels previous conclusions that hypertexts bring convenience to students’ study in terms of searching information online (Tsening 2010).

In addition, these participants also admitted that hypertexts contain the latest up-to-date knowledge and information, which is also an advantage of reading hypertexts. Furthermore, prior studies also reveal that the advent of ICT has made computers and the Internet more accessible for students than a few decades ago. Hypertexts blur constraints of time and distance, as well as allow communications and interactions amongst readers and authors. To a large extent, contemporary students enjoy the freedom of searching information and communicating online globally. Web 2.0 technologies enable students to manage their own blogs and write wikis collaboratively, which also blurs the boundary of writers and readers.

On the other hand, those students who preferred reading traditional print-based texts stated that conventional print-based texts allowed them to take notes and write short summaries on pages of what they read. In addition, some participants commented that they enjoyed the feeling of holding books or texts in their hands. In other words, they felt that reading actually happened when they turn pages. This is consistent with results of previous surveys on NESB students’ perceptions of reading hypertexts (Tseng 2010). According to previous conclusions, the linearity of conventional print-based texts also minimises possibilities of disorientation. In the present study, hierarchically structured hypertexts provided participants with a certain freedom of navigation, which can be a possible cause
of disorientation.

Over 95% participants of the present study believe that the reading comprehension strategy training program has been useful and they would apply strategies they were taught in the program in their future study. This result is consistent with Konishi’s (2003) conclusion that NESB students need to be taught reading comprehension strategies explicitly, in order to comprehend online learning materials effectively.

7.4.5 Concluding remarks of the section
Data collected from the post-test questionnaire revealed participants’ attitudes to applying reading comprehension strategies, and perceptions of reading hypertexts. Some participants stated they had learnt reading comprehension strategies before they commenced their study in Australia, whereas others had not. Summarising, making connections and paraphrasing were the top three cognitive strategies used by participants. This could be caused by participants’ prior knowledge and tasks they were asked to complete. Reviewing and planning were two metacognitive strategies that were frequently used by participants. This could occur due to the task-centred instructional principle used in the training program.

Participants who preferred reading hypertexts enjoyed the convenience brought by search functions and large volumes of information. On the other hand, those who preferred reading traditional print-based texts enjoyed the feeling of turning pages and making notes on pages. Regardless, most participants believed the reading comprehension strategy training program was helpful and would apply these strategies in their future study.
7.5 Concluding remarks

This chapter has discussed the results of the present study and linked them to relevant prior studies. Researchers have pointed out that it is of great importance to teach students, across all educational sectors, reading strategies effectively, to comprehend learning materials, either print-based or computer-based, successfully. In particular, researchers have identified the NESB students' need for instruction in reading comprehension strategies, explicitly in the context of e-learning. However, prior studies have merely included convincing quantitative data to demonstrate the influence of reading comprehension strategy training (including cognitive strategies, metacognitive strategies, and hypertext reading strategies) on NESB students' hypertext comprehension performance. On the other hand, prior conclusions on the effect of hypertext structures on students' comprehension performance are not consistent. This occurred because of the different hypertext systems used, as well as different research methods. The present study compared NESB students' comprehension performance when comprehending hypertexts with two different structures (i.e. linear structures and hierarchical structures), both before and after they received the reading comprehension strategy training program. Contemporary students have access to computers and the Web, both on and off campuses. Prior conclusions revealed that while NESB students prefer the swiftness and convenience of hypertexts, they could also experience reading difficulties, such as disorientation. Therefore, it is essential to understand their attitude and perceptions of reading online materials. The present study contained a post-test questionnaire, which asked participants their attitude to applying comprehension strategies and perceptions of reading hypertexts.

The research findings of the present study consist of three components: the influence of a reading comprehension strategy training program on NESB students' hypertext comprehension performance; the influence of different
hypertext structures on NESB students’ hypertext structures; and NESB students’ attitude to reading hypertexts, and perceptions of applying various comprehension strategies. Some of the current findings parallel previous conclusions, whereas others contradict them. Therefore, this chapter has compared and contrasted the present study with prior studies.

The results of the present study prove that NESB students’ hypertext comprehension performance can be enhanced, by receiving a well-designed reading comprehension strategy training program. Conclusions of prior studies confirm that effective reading comprehension strategy training programs can improve students’ reading comprehension performance, from primary schools to post-secondary sectors. However, limited prior studies focused on investigating the influence of a reading comprehension strategy training program on students from non-English speaking backgrounds, in the context of comprehending hypertexts. In order to fill in this gap, the present study contained a reading comprehension strategy training program that was specifically designed for NESB students who undertake post-secondary business degrees. In comparison with similar prior studies, participants in the present study received longer training hours (i.e. five one-hour training sessions on a weekly basis), learnt more strategies (i.e. cognitive strategies, metacognitive strategies and hypertext comprehension strategies), as well as accomplished more hypertext reading comprehension exercises (i.e. four sets of hypertext comprehension exercises from session 3 to session 6).

The results of the present study also revealed that NESB students’ comprehension performance, when they read linearly structured hypertexts, is better than their performance when they comprehend hierarchically structured hypertexts. In fact, conclusions on the effects of hypertext structures on students’ hypertext comprehension performance are not consistent. Some researchers concluded that linearly structured hypertexts would benefit students’ learning
outcome; whereas others argue that hierarchically structured hypertexts were a better option for educational purposes. This occurred due to the use of different hypertext systems, such as HTML and Flash MX used in prior studies. Furthermore, the provision of structure overviews can also result in students’ better comprehension performance, while reading hierarchically structured hypertexts. For instance, Waniek et al. (2003) included structure overviews in their hierarchically structured hypertexts. Their results indicated that hierarchically structured hypertexts with a structure overview could lead to better comprehension outcomes than linearly structured hypertexts.

The post-test questionnaire asked participants to express their attitude to strategy applications, and perceptions of reading hypertexts. Amongst cognitive strategies that participants were taught, summarising, making connections and paraphrasing were used frequently. This could be caused by the reading comprehension tasks (i.e. literal questions, inferential questions and critical questions) participants were asked to complete. It could also be due to participants’ prior knowledge of cognitive strategies and selected topics. In terms of the application of metacognitive strategies, participants in the present study preferred using the reviewing strategy to check and control their overall hypertext comprehension. Apart from the reviewing strategy, participants also preferred applying the planning strategies based on tasks they were required to accomplish. This may happen due to the ‘task-centred” instruction principle used in the present study. More than half of the participants claimed they preferred reading hypertexts, due to convenience and the large amount of information on the Web. On the other hand, participants who preferred reading conventional print-based texts argued that they enjoyed the feeling of holding texts in their hands, and were able to write brief comments or summaries of what they read in paper-based texts. The majority of participants agreed that the reading comprehension strategy training program was helpful, and they would apply these strategies in their future studies.
The results of the present study confirmed the two hypotheses were validated. The following chapter will recommend a teaching methodology in terms of reading comprehension strategies, in the context of comprehending hypertexts, based on research findings of the present study.
Chapter 8

A teaching methodology

Chapter 7 has discussed results of the present study and indicated their relevance to prior studies. The present study has confirmed that reading comprehension strategy training can enhance NESB students’ hypertext comprehension performance. In addition, it has indicated that a linear structure is an effective approach for organising hypertexts for educational and instructional purposes, for students from non-English speaking backgrounds. In this chapter, a teaching methodology, in terms of reading comprehension strategy training, is proposed, based on discussions in Chapter 7.

This particular methodology consists of two components: the design of the training program and the delivery of the training program. There are four elements included in the design of the training program. They are the design of hypertexts for educational and instructional purposes; the design of comprehension tasks; the design of instructional materials; and the selection of various comprehension strategies. These elements are elaborated in Section 8.2.1 to 8.2.4 respectively.

The delivery of the training program comprises the language used in the instruction, the importance of reading exercises, the importance of revision, and the application of instruction principle. These elements are elaborated in Section 8.3.1 to 8.3.4 respectively.

8.1 The overview of the teaching methodology
This particular teaching methodology aims at teaching NESB students to comprehend hypertexts successfully, as well as enhancing NESB students’ hypertext comprehension skills. It consists of the design and the delivery of a
reading strategy training program that enhances NESB students’ hypertext comprehension performance at post-secondary levels. The methodology employs a face-to-face instruction approach, so that students from non-English speaking backgrounds are able to ask questions whenever necessary. Computers and the Internet are used for NESB students to accomplish hypertext reading comprehension exercises.

The design of the training program is one of the main elements of this teaching methodology. First, the design of hypertexts for educational and instructional purposes is the core of the program. Topics should be selected from mainstream subjects, in order to accommodate NESB students’ needs to comprehend hypertexts successfully in particular domains. Hypertext structures should be decided based on the purpose of the training program. Secondly, an appropriate material should be designed for instructional purposes. NESB students are reported to experience difficulties in terms of note taking in lectures and tutorials. Thus, it is essential for teachers to organise comprehensive instructional material, and display it via a computer and a projector to NESB students. Thirdly, comprehension tasks should be designed in accordance with levels of comprehension, and readers’ mental representations. The design of comprehension tasks should be defined by the objectives of the training program. Furthermore, reading comprehension strategies taught in the training program need to be carefully selected and incorporated into the instructional material. Comprehension strategies involved in the training program ought to be chosen from different categories, based on the purposes and objectives of the training program.

The delivery of the training program is another core element of the teaching methodology. First, the language used in training sessions should be carefully considered. The instructor should take into account NESB students’ levels of English, and use plain English across all training sessions. Secondly, it is
essential to provide hypertext reading comprehension exercises, in order to apply strategies taught in training sessions. Exercises should be given to participants after the strategy instruction in every session, so that participants are able to recall strategies taught in the class as they are reading. Thirdly, revising the instructional material in every training session is important. NESB students will become sophisticated in applying various strategies when they are constantly reviewed. In addition, the overall delivery of the training program should follow instructional material suggested by prior studies (Merrill 2002). Following this sequence, the delivery of the program would be logical and effective.

In general, this particular methodology is a face-to-face training program offered to NESB students in order to improve their hypertext comprehension performance. The design and the delivery of the program are consistent with the theories, principles and conclusions made by previous research studies (e.g. Fastrez 2002; Merrill 2002). The design of the training program is discussed in detail in the following section. The delivery of the program is elaborated in Section 8.3.

8.2 The design of the training program
The design of the training program serves as the basis of reading comprehension strategy training. There are four elements in the design of the program:

- The design of hypertexts for educational and instructional purposes;
- The design of hypertext reading comprehension tasks;
- The design of an instructional material;
- The selection of various reading comprehension strategies.

The above elements are elaborated in Section 8.2.1.
8.2.1 The design of hypertexts for educational and instructional purposes

The purpose of this training program is to teach students from non-English speaking backgrounds to comprehend hypertexts successfully. Thus, hypertexts are needed for instruction and the reading comprehension exercises in the program. Four issues need to be considered while designing hypertexts for educational and instructional materials:

- Goals and objectives of reading hypertexts;
- Structures of hypertexts;
- Students’ prior knowledge;
- The interface design of hypertexts.

These issues are discussed in the following sections respectively.

8.2.1.1 Goals and objectives of reading hypertexts

Goals and objectives of reading hypertexts are defined by the ultimate purpose of a training program. It is concluded by prior studies (e.g. Verezub et al. 2008; Salmeron et al. 2009) that the purposes for reading hypertexts for educational purposes include enhancing students’ navigational skills and information searching skills, and/or enhancing students’ hypertext comprehension skills. Two approaches for organising hypertexts are suggested by Fastrez (2002), including a functionality approach and a rationality approach. A functional approach suggests that hypertexts should be organised based on searching functions and support navigational activities. However, the disadvantage of this approach is that the same concept or information can be different when activated in different contexts, by different people (Fastrez 2002). Therefore, Fastrez (2002) argues that a rationality approach is appropriate for designing instructional hypertexts. The rationality approach maintains that hypertexts should be organised logically, and be partially independent from the contexts and people who activate them. In this sense, segments of knowledge are organised semantically and logically. The
goals and objectives of the present study are to teach reading comprehension strategies to NESB students, in order to achieve better understanding of hypertexts. Thus, the rationality approach was used to structure hypertexts in the present study.

Topics and concepts of hypertexts should be selected from mainstream subjects. The reason for improving NESB students' hypertext comprehension performance is to help them effectively comprehend learning materials from mainstream subjects. Conclusions of prior studies indicate that reading strategy training should be integrated with mainstream subjects, in order to enhance students' understanding of subject-matter materials (Sanchez-Alonso & Vovides 2007). The present study focuses on enhancing NESB students' hypertext comprehension performance by teaching them cognitive, metacognitive and hypertext reading strategies. Topics of hypertexts used in the present study were selected from business management subjects, in order to cater to the needs of NESB students who undertake post-secondary business courses. Only written texts were presented in the hypertexts used in the present study. No multimedia content, such as video links or audio links, was included. The main reason for excluding multimedia content was that participants' listening comprehension skills could influence their hypertext comprehension performance. Further, the inclusion of multimedia content can put more demand on participants' working memory than written texts. Participants can get overloaded while comprehending hypertexts with multimedia content. Hypertexts related to business management were read by NESB participants in every session as part of their reading exercises. Therefore, it is essential to select adequate topics for targeted students, so as to cater to the goals and objectives of the training program.

On the other hand, if the goals and objectives of the training program are to enhance students' navigational skills, the rationality approach is still adequate for designing hypertexts. Hence, the instructors of the program need to pay special
attention to semantic linkages between nodes.

**8.2.1.2 Structures of hypertexts**

When structuring educational hypertexts, Cognitive Load Theory needs to be taken into account (for a detailed review of this theory, refer to Section 3.5.1.3). Cognitive Load Theory discusses the relationship between learners’ working memory, learning tasks and knowledge to be learnt. Two core components of this theory are intrinsic load and extraneous load. Intrinsic load is related to the nature of learning tasks, while extraneous load is defined by the way information is organised and displayed. The relevance of intrinsic load to the present study is discussed in Section 8.2.1.3. The relevance of extraneous load to the present study is presented in the present section and Section 8.2.1.4.

Hypertext structures that are appropriate for educational and instructional purposes should be used. Hypertexts can be presented under three structures, known as linear structure, hierarchical structure and referential structure. If used for educational and instructional purposes, it is recommended that linear structures and hierarchical structures be chosen (Oliver & Herrington 1995). Both linearly structured and hierarchically structured hypertexts were used in the present study, so that NESB participants’ comprehension performance of reading hypertexts with these two structures could be compared. As results show in Chapter 6, NESB participants who read linearly structured hypertexts obtained higher comprehension scores than those who read hierarchically structured hypertexts, both before and after the training. In this respect, a linear structure is recommended when designing hypertexts for educational purposes.

Reasons for selecting the linear structure are as follows.

- Linearly structured hypertexts have pre-determined reading orders, so that readers do not need to navigate through hypertext systems. In this
respect, readers do not experience disorientation while comprehending hypertexts;
- Linearly structured hypertexts exclude navigational activities, so that the extraneous load on readers' working memory is lower than hierarchically structured hypertexts.

If hierarchical structure is chosen to improve students' navigational skills in the training program, the instructor should control the balance between the intrinsic load and the extraneous load. Germane load is the third component of Cognitive Load Theory. Although it places more demand on students' working memory capacity, it increases students' willingness to learn new knowledge. Therefore, while designing hierarchically structured hypertexts for educational purposes, it is essential to inspire students' curiosity and willingness, in order to balance students' intrinsic load, extraneous load and germane load.

Graphic overviews are recommended in prior studies to decrease students' disorientation. According to conclusions made by these studies, the use of graphic overviews in hypertexts should target students' prior knowledge. Graphical overviews can be employed in educational hypertexts if targeted students possess high levels of prior knowledge on selected topics. Otherwise, graphic overviews are not able to assist students with low levels of prior domain knowledge (Muller-Kalthoff & Moller 2003; Salmeron et al. 2009).

The length of hypertexts read in each training session should be increased considerably as the training program carries on. Additionally, students' reading ability and levels of the English language should be taken into account while organising hypertexts. According to Cognitive Load Theory, long and complex texts can lead to the increase of extraneous load, while students read to learn new information (Schnotz & Kurschner 2007). In the present study, the minimum number of words is approximately 500, while the maximum number is
approximately 1,000.

The number of links in hypertexts read in each training session should increase as the training program continues. It should also be determined by the number of training sessions contained in the training program. Hypertexts read in the second training session (the first training sessions contained reading comprehension strategy instruction only) of the present study contained five links. Participants were asked to complete three comprehension questions in this session. The number of links remained the same in the third training session. Six comprehension tasks were prepared for participants in this session. Seven hyperlinks were attached to hypertexts read in the fourth training session, with six comprehension questions. In the last training session, participants were required to read hypertexts with nine links, and accomplish nine comprehension questions. This situation was similar to settings of the pre- and post-tests. This particular design was based on Merrill's (2002) argument that teacher instruction and supervision should be withdrawn as the instruction carries on, and students should be given increasing opportunities to practise what they have learnt. Merrill's (2002) instructional principles are recommended in Section 8.3.4.

8.2.1.3 Students’ prior knowledge

Students’ prior knowledge needs to be taken into account, in order to maximise the outcome of the training program. In terms of comprehending hypertexts, students' prior knowledge consists of two components: domain prior knowledge and system prior knowledge (Waniek & Schafer 2009). Domain prior knowledge refers to students’ existing knowledge of selected hypertext topics. System knowledge is students’ experience with current hypertext systems. As stated in Section 8.2.1.1, topics are defined by the purposes of the training program, as well as mainstream subjects to which the training program is linked. According to Cognitive Load Theory, when comprehending texts that are beyond readers’
domain prior knowledge, the demand on readers’ working memory increases (Schnotz & Kurschner 2007). Therefore, it is of great importance that selected hypertext topics should be consistent with targeting students’ levels of domain prior knowledge. The present study selected business management topics and concepts for designing hypertexts, since business management subjects are core subjects amongst all post-secondary business degrees in Swinburne University of Technology. In addition, subject-matter experts should be invited to review hypertext content to ensure its accuracy and appropriateness. In the present study, all concepts and relevant information have been selected from reputable textbooks and online resources. Before being presented to participants, all hypertexts were reviewed by a management subject convener.

The readability of hypertexts should be tested before presenting them to students. Readability refers to the degree of complexity of a text, in terms of the length of its words and sentences. Levels of text complexity should not exceed targeted students’ levels of prior knowledge and levels of the English language. Flesch-Kincaid readability tests were employed in the current study (for detail of this test and its relevance to the present study, refer to section 5.5.2). In the present study, the average readability score is 40, which is appropriate for Grade 11 and Grade 12 native English speaking students.

Hypertext Markup Language (HTML) is one of the core elements in the construction of web pages and websites. It is reported that contemporary post-secondary students (both native and international students) are familiar with computers and the Internet, due to the widespread decrease in ICT prices (Jones et al. 2010). HTML has been employed as the platform to display texts in the current study. According to the post-test questionnaire, most participants enjoy surfing and reading online information in their daily lives. In this respect, the influence of poor system knowledge has been minimised. Additionally, all participants were given a short instruction prior to the pre-test, in order to avoid
confusion while comprehending hypertexts.

8.2.1.4 The interface design of hypertexts

The overall interface layout should be clearly presented with appropriate selections of background colours, fonts and spaces. As argued by Cognitive Load Theory, inappropriate interface layout of hypertexts can raise readers’ extraneous load. In that case, the demand on readers’ working memory can be increased as well.

Formats suggested by Hemard (1997) are recommended for adapting hypertext presentations (Figure 8.1). Hemard (1997) argues that the core information of each hypertext should be presented in Area A, no matter which format is chosen. Area B and C can be used for navigational support to minimise disorientation (Hemard 1997). An adjusted version of Type A has been selected to display hypertexts in the present study (for detail, refer to Section 5.5.2).

![Figure 8.1 Different presentations of display patterns.](Source: Hemard 1997)

Background colours and font colours should not be mismatched. Prior studies
have suggested that mismatched colours for the background and fonts can lead to reading difficulties while comprehending hypertexts. This is the case in particular when students comprehend hypertexts in foreign languages. Background colours should be limited and consistent from session to session. The contrast between background colours and font colours should be appropriate and avoid extreme matches, such as green and yellow (Tinland 2005). In the present study, the colour of fonts is mainly black, with some headings or titles in white.

Fonts should be chosen from slab-serif or sans-serif, with 1.5 line spacing, and with a mixture of upper and lower case letters. The size of fonts used in main texts and nodes should be medium. The size of fonts used for titles and headings should be large. Hypertexts should be left-justified, which is consistent with presentation of texts in print-based texts. In the present study, Arial font has been selected with 1.5 spacing, and is left-justified.

If the reading comprehension strategy program is designed to accommodate students’ needs in hypertext navigation, graphic overviews can be used when designing hypertexts. Prior studies suggest that graphic overviews should be placed at an appropriate position on the interface – for instance, at the beginning of hypertexts. Otherwise, graphic overviews may hinder hypertext navigation and comprehension, and in particular, disadvantage students who have low levels of prior domain knowledge.

The above elements are concerned with the design of hypertexts used for a reading strategy training program. In order to measure students’ hypertext comprehension performance, the design of comprehension tasks is important. The following section discusses key elements related to designing adequate comprehension tasks for the training program.
8.2.2 The design of comprehension tasks

The selection and the design of comprehension tasks depend on the goals and objectives of the training program. The experience of the present study, and previous ones, recommends different types of comprehension questions to measure hypertext comprehension. If the training program aims at improving students’ hypertext reading comprehension performance, expressive comprehension questions and cloze tests can be used to measure their mental representations and general understanding of hypertexts. If the training program aims at strengthening students’ searching and navigational skills, then free-recall questions can be used.

The present study used literal, inferential and critical questions to measure participants’ comprehension performance (for detail, refer to Section 5.5.4). Questions should be worded clearly. Answers to literal questions could be found in hypertexts explicitly. Inferential questions require students to draw inferences from information stated in different sections, and/or nodes, of hypertexts. Thus, inferential questions should encourage students to make such inferences, and deepen their understanding of hypertexts. Critical questions evoke students’ prior knowledge and encourage them to link new information to their prior knowledge. In this respect, critical questions should be designed in accordance with students’ prior knowledge of given topics. It is suggested these questions should be presented in a print format, with reasonable spaces for students to write down their answers. This is to minimise the influence of students’ typing skills on the time they finish answering questions (Sanchez-Alonso & Vovides 2007). It is also to avoid the effects of unexpected technological errors, as the training program continues.

Besides literal, inferential and critical questions, cloze tests can also be used to measure students’ overall comprehension of hypertexts. Greene (2001) conducted a study to test the validity of using cloze tests to measure
post-secondary students’ comprehension of print-based texts. He argues that well designed cloze questions are able to test the overall construction of new knowledge established by post-secondary students, as well as their recognition text coherence. In the study conducted by Verezub et al. (2008), cloze questions were employed to measure post-secondary students’ hypertext comprehension in a metacognitive strategy-training program. The purpose of Verezub et al.’s (2008) study was to examine the effects of metacognitive strategy training on students’ hypertext comprehension. The results of this study revealed that students’ scores on cloze questions were significantly enhanced after the training program. Although the present study did not include cloze questions, this particular type of comprehension question is applicable when researchers intend to measure students’ overall understanding of hypertexts.

Prior studies have also employed free-recall questions to measure students’ hypertext comprehension performance. This particular type of comprehension measurement was utilised when students’ searching and navigational behaviour was the core of studies. Thus, it is suggested free-recall questions can be used as a comprehension measurement, when a training program aims at improving students’ searching and navigation skills.

8.2.3 The design of instructional materials
Although the training program aims at improving students’ hypertext comprehension skills, a conventional face-to-face instructional approach should be used. Reasons for using a face-to-face instructional approach include:

- It offers opportunities for NESB students to raise questions whenever necessary. Prior studies on international students’ learning behaviour in Australia argue that 80% of international students come from countries where teacher-centred teaching and learning styles are popular. Most international
students in Australia are not motivated to ask questions, both in and after classes, since they feel isolated and scared in an English-speaking environment. Thus, encouraging international students to ask questions, whenever necessary, is a key issue to improving their participation in classes. In the present study, a conventional face-to-face instructional approach was used, where students were told that they were welcome to raise questions whenever they felt confused.

- It allows students to get immediate responses from teachers whenever they have questions. Conclusions of previous studies argue that one drawback of online instruction is that it can take some time for students to receive teachers’ responses to their questions. In a face-to-face instructional environment, teachers are able to help students resolve problems and overcome difficulties they experience in classes. In the present study, questions raised by students in every session were solved and explained in a timely manner, and not left to the following session.

- It enables face-to-face interactions amongst students and teachers. Prior studies remark that many international students do not take part in discussions in classes, due to their cultural backgrounds and limitations in the English language. The present study employed a face-to-face instructional approach to offer a comfortable environment to NESB participants, and provided opportunities for them to interact with peer students and the instructor.

- It maintains students’ participation in classes. The effectiveness of online instructional activities is questioned by relevant literature, due to the lack of monitoring and supervision from teachers. On the other hand, face-to-face instructional approaches allow teachers to supervise and monitor students’ learning activities. In the present study, not only were participants supervised
by the instructor in training sessions, they were also asked how the next session could be improved.

A number of computer-based metacognitive strategy training mechanisms, such as iSTART and 3D-Reader (for detail, refer to Section 3.6), have been recommended in previous research studies. It has been proven that students’ hypertext comprehension performance improves using these computer-based mechanisms. However, these training mechanisms were seldom employed to enhance NESB students’ hypertext comprehension performance in prior studies. In this respect, the effectiveness of these computer-based training mechanisms on NESB students remains to be explored. The present study did not use a computer-based metacognitive strategy training mechanism, in order to strengthen interactions and communication amongst peer students and the instructor, and enhance students’ sense of participation. If future studies intend to incorporate metacognitive strategy-training software into a training program for NESB students, it is essential to take into account students’ participation in classes.

Although the present study employed a face-to-face instructional principle, the current reading strategy training program could be implemented in a blended learning environment. Blended learning requires thoughtful integration of conventional instructional principles and ICT. One possible recommendation is that students receive computer-based instructions of reading strategies, and complete all hypertext comprehension tasks in a computer room, with a teacher who provides critical supervision and assistance whenever necessary. In this regard, students can obtain instant feedback and solutions for their questions, and teachers are able to update the computer-based instructional approach, based on students’ questions and feedback. There is no doubt that incorporating a reading strategy training program with blended learning is consistent with contemporary trends in the domain of education. However, it should be noted that
this particular incorporation needs to be planned and implemented carefully, in order to maximise the benefit of the training program and avoid possible drawbacks brought up by computer-based instructions.

The reading strategy training program could also be conducted in an online environment, since e-learning blurs boundaries of time and distance. Students are able to receive all training sessions and accomplish comprehension tasks online, regardless of their geographical position. In particular, it is essential to offer opportunities for e-learning students who participate in this program to communicate and interact with teachers and peer students, either asynchronously or synchronously. Blogs could be considered as one option that attracts e-learning students to express and exchange their opinions and perceptions of such an online reading strategy training program, if it is carefully planned and thoughtfully integrated with the online training. Prior studies (e.g. Shen and Liu (2011)) have indicated that sophistication of web design for educational and instructional purposes is critical; otherwise, the outcome of reading strategy training may not be as beneficial as expected. Meanwhile, online communication and interaction between teachers and students requires teachers to respond to students’ inquiries as promptly as possible, in order to minimise possible confusion and disorientation experienced by students. Apart from online communication and interaction, e-learning students’ participation should be another concern. If future studies intend to organise a reading strategy training program in a purely online environment, instructions of self-regulated strategies and methods need to be included in the training program, in order to get online students to engage in the training effectively.

The instructional material should be organised and presented clearly and logically. An overview of content in every training session should be shown to participants first, so that participants obtain a preview of information to be learnt. Definitions of terminologies, such as reading strategies and hypertexts, should be written in
plain English, which suits students’ levels of the English language. Explanations of various strategies need to be presented in short and clear sentences. In the instructional material, it is essential to recap the core content of the session before the instruction finishes. Furthermore, students need to be informed of key activities for the following session.

In the present study, the definition of cognitive strategies, for example, was first presented to students. Secondly, the instructional material introduced metacognition and metacognitive strategies. Then, hypertext reading strategies were explained to students. The explanation of the term “hypertext” was included in the instructional material. Lastly, key concepts were recapped and activities for the following session were shown to participants. The instructional material was presented in Microsoft Powerpoint and shown to students via a projector in each session.

The key components of the training program are reading comprehension strategies. Thus, the selection of various strategies from existing theories is of great importance. The next section discusses issues that need to be taken into account while designing the training program.

8.2.4 The selection of various reading comprehension strategies
Teaching students to apply various reading comprehension strategies while comprehending hypertexts is the fundamental consideration of the training program. Therefore, reading comprehension strategies should be chosen from existing theoretical models, based on the goals and objectives of the training program.

Reading comprehension strategies have been classified into different categories by different researchers and scholars. O’Malley and Chamot (1990) suggest that there are three categories of comprehension strategies, including cognitive
strategies, metacognitive strategies, and socio-affective strategies (for detail, refer to Section 3.2.1 to Section 3.2.3). Block (1986) and Anderson (1990) introduce three clusters of comprehension strategies, known as global strategies, local strategies and support strategies (for detail, refer to Section 4.3). In terms of specific strategies for comprehension hypertexts, link selection strategies are recommended by prior studies (Salmoron et al. 2010; Protopsaltis 2008), (for detail, refer to Section 3.2.4). Since the present chapter recommends a teaching methodology for reading strategies (in the hypertext context), the categories selected are cognitive strategies, metacognitive strategies, and hypertext reading comprehension strategies. Main considerations for selecting the above comprehension strategies are elaborated in detail in the following sections respectively.

8.2.4.1 The selection of cognitive strategies

Existing literature has remarked that NESB students at post-secondary levels learn cognitive strategies in their mother tongues; however, they cannot name these strategies in English properly (Lawrence 2007). In this respect, post-secondary NESB students should be reminded of a number of frequently used cognitive strategies to evoke their prior knowledge of reading comprehension strategies. While selecting cognitive strategies for NESB students in the instruction, it becomes essential to review relevant literature and incorporate purposefully chosen strategies into the instructional material.

The present study incorporated five cognitive strategies into the instructional material, including summarizing, paraphrasing, predicting, visualizing and making connections (elaboration in O’Malley and Chamot’s (1990) model). This particular combination of cognitive strategies was determined, based on recommendations of prior studies (Verezub 2008; Fotovatian & Shokrpour 2007).

Explanations of selected strategies should be expressed explicitly in plain
English, in order to cater to the levels of the English language targeted students possess. Moreover, it is essential to avoid confusing students by using technical terms during the instruction. In the present study, the term ‘comprehension approaches/methods’ was used to represent cognitive strategies in the instruction, in case NESB participants were confused by the terms ‘metacognitive strategies’ and ‘cognitive strategies’.

8.2.4.2 The selection of metacognitive strategies

The selection of metacognitive strategies lies in the goals and objectives of the training program, as well as participants’ levels of prior knowledge and the English language. Existing literature has emphasised the importance of teaching students to read metacognitively, in order to comprehend learning materials. Although phrased slightly differently in different frameworks, the core of metacognitive strategies remains the same, which is to plan, monitor, evaluate and review readers’ reading processes. In order to provide NESB students a specific view of metacognition and metacognitive strategies, the Parlincsar and Brown (1989) model was selected in the present study. Furthermore, metacognitive strategies in hypertext reading comprehension, suggested by Lee and Baylor (2005), were expanded, based on Parlincsa and Brown’s (1990) model. This particular model has also been used in previous studies that aimed at teaching students to read hypertexts metacognitively (e.g. Verezub 2008). Thus, the current study has chosen a fundamental theoretical framework in terms of metacognitive strategy instruction.

According to Anderson (2003), global strategies are popular amongst NESB students when they are reading hypertexts. However, this conclusion is drawn from surveys and interviews of NESB students, instead of the analysis of quantitative data. Thus, it relies on future studies to test NESB students’ applications of such strategies while comprehending hypertexts.
In addition, these selected metacognitive strategies should be re-worded in the instructional material, to accommodate participants’ levels of the English language. Metacognition and metacognitive strategies are written in highly technical language in relevant literature, which may not be comprehended by NESB participants. Thus, explanations of each strategy need to be written in simple and clear sentences.

8.2.4.3 The selection of hypertext comprehension strategies

Hypertext comprehension strategies need to be chosen depending on the goals and objectives of the training program. If comprehending educational hypertexts is the main concern of the program, strategies that highlight the importance of establishing mental representations of hypertexts should be selected. If the program intends to enhance students’ navigational skills, strategies that assist students to avoid disorientation, and build a coherent understanding of hypertexts should be used. In addition, if blogs and wikis are employed, then socio-affective strategies should also be taken into consideration.

The fundamental purpose of training sessions in the present study was to increase NESB students’ hypertext comprehension performance. Although participants who read hierarchically structured hypertexts were required to undertake limited navigational activities while comprehending hypertexts, navigation was not the major focus of the present study. Thus, hypertext comprehension strategies taught to students in the present study concentrated on enhancing students’ mental representations of hypertexts (Appendix III). Students were taught to make connections amongst nodes to establish different levels of mental representations.

On the other hand, if information searching tasks are included a training program, link selection strategies should be taught to students. Both Salmeron et al. (2010) and Protopsaltis (2008) suggest link selection strategies while interacting with
hypertexts. The application of these link selection strategies also depends on the design of hypertexts, in particular hypertext structures and interface design.

Blogs and wikis are widely applied for educational purposes. If they are included in a training program, socio-affective strategies should be highlighted. In this respect, students can enhance their communication skills with peer students and teachers by exchanging ideas and opinions online.

8.2.5 Summary of the design of the training program
This section concentrates on the design of a training program that aims at enhancing NESB students’ hypertext comprehension performance. Four aspects of the training program design have been discussed in the section: the design of hypertexts for educational purposes, the design of comprehension tasks, the design of the instructional material, as well as the selection of various reading comprehension strategies. Goals and objectives of the training program define the above four aspects. This section makes recommendations on issues related to the design of a reading strategy training program for students from non-English speaking backgrounds, to improve their hypertext comprehension performance. It also offers a number of suggestions for the design of a training program that aims at enhancing NESB students’ searching and navigational skills.

First, educational and instructional hypertexts should be designed based on the goals and objectives of the training program. To improve NESB students’ hypertext comprehension performance, it is advisable to use linearly structured hypertexts. On the other hand, hierarchically structured hypertexts can be used if the training program intends to improve NESB students’ performance when navigating through educational hypertexts. It is essential to take into account Cognitive Load Theory when designing hypertexts, so as to reduce demand on students’ working memory. Students’ prior knowledge, including domain knowledge and system knowledge, should be considered when designing
hypertexts. Reading strategy training should be incorporated into mainstream subjects, in order to assist students to effectively comprehend the online learning materials of their subject matter. The interface of hypertexts should be organised and presented appropriately, based on recommendations and conclusions made by prior studies.

Secondly, the design of comprehension tasks needs to follow the goals and objectives of the training program. Literal, inferential and critical questions can be used to measure different mental representations of hypertexts. Cloze tests can be used to measure the overall understanding of hypertexts established by students. If navigation activities are included, free-recall questions can also be employed.

Thirdly, the instructional material should be designed in accordance with NESB students' learning behaviour, as well as the goals and objectives of the training program. Face-to-face instruction is recommended, based on suggestions made by previous studies and the results of the present study. It is important to write the instruction material in plain English.

Furthermore, reading comprehension strategies should be carefully selected from existing theoretical frameworks. The focus of strategy instruction should be on cognitive, metacognitive and hypertext reading strategies. The selection of cognitive strategies needs to rely on NESB students' prior knowledge on such strategies. Hypertext comprehension strategies need to be chosen based on the goals and objectives of the training program, as well as structures of hypertexts used in the program. If blogs and wikis are used for educational purposes, socio-affective strategies should also be considered.

A well designed training program should be implemented in conjunction with explicit instruction. The following section recommends four key components of
the delivery of the training program.

8.3 The delivery of the training program

Teaching NESB students reading comprehension strategies ought to implement adequate instructional principles, in order to optimise the outcome of the training program. This section focuses on making suggestions in terms of delivering an effective reading strategy training program to students from non-English speaking backgrounds. There are four components included in the delivery of the training program:

- The language used in the instruction;
- The importance of reading comprehension exercises;
- The importance of revision;
- The application of instructional principles.

Section 8.3.1 to Section 8.3.4 elaborate these components respectively.

8.3.1 The language used in the instruction

Clear and comprehensive language needs to be used while delivering the training program to NESB students. NESB students suffer difficulties in terms of note taking and comprehending learning materials, due to the constraints of using the English language (Mulligan & Kirkpatrick 2000). Therefore, it is vital to avoid overwhelming NESB students when delivering instructions of various reading comprehension strategies. Three issues should be considered in training sessions, in terms of the usage of the English language:

- Oral explanations of selected strategies;
- Examples used in training sessions;
- Class interactions.
The above issues are explained in detail from Section 8.3.1.1 to Section 8.3.1.1.

8.3.1.1 Oral explanations of selected strategies

Oral explanations of selected strategies affect students’ understanding of strategies. Oral explanations should be delivered to students in clear and comprehensive English. Explanations of strategies and relevant concepts are written in sophisticated language in relevant literature. In order to maximise NESB students’ understanding of selected strategies and concepts, oral explanations should be simplified. Words and expressions need to be consistent with students’ levels of the English language. Moreover, the speed of oral explanations should be moderate, in order to help students follow the instruction.

In the present study, the language used in training sessions during different experimental phases was familiar to participants. Terminologies that went beyond their current levels of the language were explained in simple, short sentences.

8.3.1.2 Examples and metaphors used in training sessions

Selected strategies need to be illustrated to students in conjunction with proper examples. This principle is highlighted in both Duff (2002) and Merrill’s (2002) theoretical frameworks. An instructor should employ examples to help students to build linkages between strategies they learn and their knowledge of the real world (Merrill 2002). In addition, appropriate metaphors should be used, in order to describe terminologies effectively to students. The instructor should use examples that are relevant to students’ everyday study and life, to demonstrate different strategies. In the present study, examples of each strategy were given to students, alongside oral explanations of these strategies. Examples were related to participants’ subject-matter topics and concepts, so as to deepen their understanding of various strategies. In this respect, participants’ previous experience was activated and connected to newly learnt strategies. Moreover,
Facebook, Wikipedia and blogs were used as examples to assist participants’ understanding of different strategies.

8.3.1.3 Class interactions

Prior studies highlight that NESB students’ participation in class activities is relatively poor, due to language constraints and cultural differences. Encouraging students to take part in class interactions becomes a critical issue for teaching and learning activities at post-secondary levels of education. Therefore, interactions amongst the students and with the instructor are important. Class interactions can allow the instructor to obtain information about students’ levels of the English language. Also, interactions amongst students and teachers can diminish feelings of discomfort in classes, since they are able to express themselves to each other, and exchange opinions and previous experiences. Furthermore, the instructor can discern students’ attitudes and perceptions of the training program.

In the present study, class discussions were included in the first training session. Students were encouraged to exchange their opinions in terms of applications of strategies in the exercise. At the end of the first training session, students were encouraged to apply strategies learnt in their everyday study. From the second training session, students were asked about their experience applying the various strategies they had learnt in the previous week. They were encouraged to share their own understandings of the strategies. The author also shared her own experience with participants in terms of the application of different strategies.

8.3.2 The importance of reading comprehension exercises

Integrating reading comprehension exercises in training sessions allows students to apply strategies they are taught. This principle is emphasised in both Duffy’s (2002) and Merrill’s (2002) principles of instructions. In Duffy’s (2002) model (for detail, refer to Section 5.6), it is argued that students should receive guided
practices during the instruction, and gradually gain sophistication as the instruction continues. In this regard, students obtain opportunities to construct their understandings of strategies they learnt, as well as apply these strategies in their subject-matter learning materials. Merrill’s (2002) First Principles of Instruction highlight that learning is effective and meaningful when students are given opportunities to link new knowledge to practices.

Five training sessions were included in the present study. The first training session contained instructions so that participants could receive detailed explanations of selected strategies and maximise their understandings of these strategies, without being overwhelmed. In addition, participants had an exercise to do to practice the application of reading strategies they had learnt. From training session 2 to training session 5, participants received hypertext comprehension exercises in every session after the revision of strategies.

According to Duffy’s (2002) principles, students should become sophisticated as the training program carries on, due to the practices they are given. In the present study, the length of hypertexts and the number of comprehension questions gradually increased from training session 3 to training session 5. It paralleled the principle proposed by Duffy (2002).

In the application principle suggested by Merrill (2002), the function of feedback is also emphasised. Merrill (2002) maintains that effective learning lies in constructive feedback. In the present study, participants were given feedback on their performance in the previous session, as well as answer guidelines. The author explained the answer guideline orally, so as to further their understanding of both subject-matter concepts and strategies taught in the training program.

One of the purposes of the training program is to enhance NESB students’ hypertext comprehension skills. In particular, this training program intends to
improve NESB students' hypertext comprehension skills by teaching them various reading comprehension strategies. According to Afflerbach et al. (2009), proficient readers apply their reading comprehension skills automatically. On the other hand, readers select strategies accordingly when they are reading. Reading comprehension strategies can become reading comprehension skills, as readers apply strategies frequently in practices. In this respect, integrating hypertext comprehension strategies into training sessions is a critical step for students to transfer learnt strategies into hypertext comprehension skills.

8.3.3 The importance of revision
Revision should be provided for students in each training session, to reinforce strategies taught in the training program, and evoke students' prior knowledge. Merrill (2002) argues that adequate coaching plays an essential role in the application principle. Also, he maintains that coaching should be gradually withdrawn as the teaching activities continue, since students need more opportunities to apply new knowledge or theories. Revision and hypertext comprehension exercises should be implemented together, to deepen students' understanding of strategies they are taught. In Duffy's (2002) framework, the function of revision is highlighted. Repeatedly emphasising the importance of selected strategies can assist students in establishing better connections between strategies and subject-matter materials. Duffy (2002) also argues that coaching/revision should be diminished, so that students are able to re-structure their understandings of strategies they have learnt.

In the present study, revision of strategies started from the second training session. Participants were asked to complete hypertext reading comprehension exercises, after the revision. The revision was shorter and shorter as the program carried on. On the other hand, hypertexts and the number of comprehension tasks increased respectively.
8.3.4 The application of instruction principles

The appropriate application of existing instruction theories plays an essential role in the delivery of a training program. In this section, two instruction frameworks are recommended, based on the results of the present study. They are:

- Direct Explanation of Strategies (DES) (Duffy 2002), which highlights key issues in terms of reading strategy instruction;
- The First Principle of Instruction (Merrill 2002), which concerns the overall instructional design, and the design of teaching and learning activities.

These two frameworks are elaborated in conjunction with their applications in the present study and suggestions for future studies.

8.3.4.1 Direct Explanation of Strategies (DES)

Direct Explanation of Strategies (DES) principles are proposed by Duffy (2002). It emphasises key issues and steps in instructional activities while teaching students to apply reading comprehension strategies. Duffy (2002) maintains that teachers are in charge of selecting and teaching reading comprehension strategies, so that students are able to comprehend texts successfully. Six steps used when teaching students reading comprehension strategies are:

- Teachers introduce what is to be read in the class;
- Teachers explain strategies to be learnt and to be used in reading comprehension exercises;
- Teachers provide examples of applications of such strategies while reading;
- Adequate exercises should be prepared for students so that they have opportunities to apply newly learnt strategies;
- Reading comprehension practices should enhance students’
understandings of subject-matter materials;

- Teachers should recap key strategies taught in the class and encourage students to apply these strategies in their everyday study (for DES’s relevance to the present study, refer to Section 5.6).

In general, DES emphasises that explicit strategy instruction should be delivered to students prior to reading comprehension exercises. This particular framework implies the importance of incorporating subject matter content into a reading comprehension strategy instruction. In addition, revision of strategies and reading comprehension exercises are also key components in the training program.

Besides the above core steps of teaching reading comprehension strategies, Duffy (2002) also suggests six activities that teachers can employ during the instruction. They are:

- Establishing the importance of reading comprehension strategy instruction;
- Explaining strategies clearly with appropriate examples and providing adequate exercises for students to apply newly learnt strategies;
- Repeating the importance of strategies and the ongoing demonstration of selected strategies with clear examples;
- Providing students multiple opportunities to perform strategies with critical support and supervision; and withdrawing support and supervision gradually;
- Assessing students’ usage of various strategies and their comprehension of subject-matter materials;
- Making constant connections between comprehension strategies and subject-matter materials.
The above activities have also been conducted in the present study (for detail, refer to Section 5.6). DES has also been employed by previous studies. For instance, Verezub et al. (2008) employed this particular framework as a guideline to deliver training sessions to TAFE students to improve their hypertext comprehension performance. The results of the study indicate that students’ hypertext comprehension is significantly improved after the training. In the present study, the DES framework was employed to teach NESB participants who undertake post-secondary degrees in Swinburne University of Technology. The results of the present study reveal that the training program, which integrated with DES, enhances NESB participants’ hypertext comprehension strategies. Thus, DES can be used as the guideline for reading comprehension strategy instruction in the training program.

8.3.4.2 First Principles of Instruction

The First Principles of Instruction model was developed by Merrill (2001;2002; 2009). The core of this framework is to design and deliver instructions based on tasks that students need to accomplish. There are four key instructional phases that need to be considered based on tasks designated, activation, demonstration, application and integration. Figure 8.2 shows the dynamic between tasks, activation, demonstration, application and integration.
Figure 8.2 The interrelationship amongst tasks and four instructional phases
(Source: Merrill 2002)

The above figure (Figure 8.2) shows the interrelationship amongst tasks and the four instructional phases in the First Principles of Instruction. Tasks that students need to be able to complete are centred in the First Principles of Instruction. Tasks determine the goals and objectives of instructions, and thus determine the design of the four instructional phases (i.e. activation, demonstration, application and integration). Merrill (2002; 2009) suggests that the instruction should start with activating students’ prior knowledge that is relevant to selected tasks. Teachers explain theories to students in the demonstration phase with adequate examples. At the application phase, students need to apply new knowledge, in order to complete selected tasks and/or resolve problems. The dynamic amongst tasks and/or problems and four phases is elaborated below:

- Task-centred instructional strategy. Merrill (2009, p. 49) defines a task-centred instructional strategy as “direct instructions in the context of authentic, real-world problems or tasks”. Students’ learning outcome is increased when a task-centred instructional strategy is used. Also, a task-centred instructional strategy enhances learning outcomes, as it requires students to undertake a simple-to-complex progression. In
general, teachers need to demonstrate the first selected tasks, and teach students key skills to accomplish the task. Then, teachers need to provide opportunities to apply key skills. This process needs to be recycled when teachers demonstrate the second task, which should be more complex than the first one. The amount of coaching that students receive in the second round ought to be shorter than in the first round. This particular cycle continues until students master key skills to complete this type of task without any coaching. The present study implemented this strategy. Participants were given brief overviews of tasks they needed to complete at the beginning of each training session. Then, they were taught various selected reading comprehension strategies with appropriate examples, which was followed by hypertext comprehension exercises. The length of strategy instruction was shorter and shorter as the program continued; at the same time, the number of hyperlinks and the number of comprehension tasks increased.

- Activation principle. Evoking students' relevant prior knowledge or experience can enhance the learning outcome. Moreover, it is important for students to share their prior knowledge and experience at the activation phase. Activating and sharing prior knowledge and experience can direct students to recall correct, or relevant existing mental models in their knowledge bases. In the present study, participants were asked to recall and share their online reading experiences. They were also encouraged to exchange their reading experiences in terms of comprehending their subject-matter materials.

- Demonstration principle. Desired skills for completion of selected tasks need to be demonstrated explicitly. While demonstrating key skills, appropriate guidance and examples should be given to students to connect new knowledge to their prior knowledge. In addition, peer
discussion and peer demonstration are vital components in the demonstration phase. In the present study, participants were taught various reading comprehension strategies, with explicitly simple and clear examples. Examples were selected from their daily study experience or daily lives. Peer discussion and demonstration were employed in the first training session, where participants were asked to have discussions on the exercise they had completed.

- Application principle. Students need opportunities to practise skills they are taught, with constructive feedback. Coaching from teachers is needed when students start applying new knowledge. However, coaching can be withdrawn gradually, as students become more proficient as the instruction carries on. Merrill (2009) highlights peer collaboration at the application phase. In the present study, participants started having hypertext comprehension exercises after reading strategy instruction. Supervision and coaching in each training session decreased as more hyperlinks and comprehension tasks were included in hypertext reading exercises. Also, participants were encouraged to exchange their opinions and experience of applying strategies.

- Integration principles. Students need to integrate new knowledge into their existing knowledge frameworks. Students should be encouraged to apply new knowledge in their everyday life. The more they use the new knowledge, the more proficient they can become. Thus, application leads to proficiency, while proficiency enhances integration. In the present study, participants were asked to apply various strategies from the training program to their everyday study, and share their experience in the following session. This parallels Afflerbach et al.’s (2009) argument that reading comprehension strategies learned by students can become a part of their skill set, as long as they keep practicing them.
8.3.5 Summary

Section 8.3 discusses four key issues for implementing a deliberately designed training program; these include, the application of instructional principles, the language used in the instruction, the importance of revision, and reading comprehension exercises.

The first issue that needs to be considered when delivering the training program lies in selecting appropriate instructional principles. Based on the experiment and results of the present study, Duffy’s (2002) Direct Explanations of Strategies (DES) and Merrill’s (2002) First Principles of Instructions are recommended. DES (Duffy 2002) highlights six specific principles, while teaching reading comprehension strategies to students. Duffy (2002) suggests that reading comprehension strategies be taught to students explicitly, with adequate examples and deliberately designed exercises. First Principles of Instructions (Merrill 2002) introduces five key components to effectively deliver instructions. Tasks to be solved by students are placed in the centre of First Principles of Instructions, surrounded by activation, demonstration, application and integration. Both theories highlight the importance of examples, revision and exercises (applications). In the present study, these two theories were employed in the context of teaching NESB students to comprehend hypertexts.

The language used in the training program should target students’ levels of prior knowledge, and levels of the English language. Both Duffy (2002) and Merrill (2002) address the importance of examples in instructions. Taking into account students’ prior knowledge is essential for teachers to provide comprehensive examples in instructions. In addition, since the training program aims at teaching hypertext comprehension strategies to students from non-English speaking backgrounds, it is vital to consider students’ levels of the English language. Words and expressions used in instructions should be comprehensive and explicit. Proper metaphors and class interactions should be included in the
training program to enhance a sense of participation. In the present study, language used in training sessions was plain and clear. Examples used in training sessions were related to participants’ mainstream subjects.

Opportunities for applying learnt strategies/theories should be incorporated into the training program, so that students are able to practice new knowledge. In the present study, students were asked to complete hypertext comprehension exercises in training sessions, so as to apply the strategies they were taught. Also, they were encouraged to apply these strategies in their daily study, and discuss their personal experience in the following session.

Revision of strategies is highlighted by Duffy (2002) and Merrill (2002), since it reminds students of key components they have learnt. In the present study, revision was included in every training session, the length of which was decreased gradually as the program carried on. This parallels Merrill’s (2002) suggestion, that coaching and supervision should be withdrawn as students become more sophisticated in their application of the strategies.

8.4 Concluding remarks
This chapter has recommended a teaching methodology that can be used to improve NESB students’ hypertext comprehension performance. A teaching methodology, consisting of the design and the delivery of a reading comprehension strategy training program for NESB students, has been elaborated in the chapter.

In general, the aim of the training program determines the design and delivery the program. The aim of the reading strategy training program in the present study is to enable students from non-English speaking backgrounds to effectively comprehend online learning materials, or hypertexts. Nevertheless, this chapter
also contains relevant recommendations on training programs aiming at enhancing students’ navigational skills. It is recommended in both cases that the training program, regardless of its aims, should contain well designed instruction sessions and exercises that allow students to practice strategies they have learnt.

8.4.1 The design of the training program

When designing the program, four issues should be considered. They are the design of hypertexts, the design of hypertext comprehension tasks, the design of instruction material, and the selection of reading comprehension strategies.

First, the design of hypertexts should take into account four issues: the goals and objectives of reading hypertexts, structures of hypertexts, students’ prior knowledge, and the interface design of hypertexts. The goals and objectives of reading hypertexts define structures of hypertexts. If the training program aims at improving students’ navigational skills, hierarchically structured hypertexts can be used. On the other hand, if hypertexts are designed to improve students’ reading comprehension skills, linearly structured hypertexts are highly recommended. The results of the present study confirm that linearly structured hypertexts can lead to NESB students’ better understanding of hypertexts than hierarchically structured hypertexts. It is recommended that the rationality approach for organising hypertexts be used, in order to effectively design hypertexts for educational purposes (Fastrez 2002). Additionally, topics used in the program should be selected from mainstream subjects, so that students’ understanding of such subjects can be enhanced via the program (Sanchez-Alonso & Vovides 2007). Students’ prior knowledge consists of their prior domain knowledge and prior system knowledge. Taking into account their prior knowledge, when designing hypertexts, can minimise students’ experience of cognitive overload. A readability test should be conducted, in order to balance students’ cognitive load while comprehending hypertexts. The interface of
hypertexts should be considered carefully. Positions of main texts and links, the match of background colours and font colours, and the size of fonts, should be well planned.

Secondly, the design of reading comprehension tasks lies in the goals and objectives of the training program. If the program aims at teaching students to comprehend hypertexts effectively, literal questions, inferential questions and critical questions can be used to test different levels of mental representations formed by students. Cloze tests can also be used to test students’ general understanding of the hypertexts they are asked to read. If the program aims at improving students’ navigational skills, it is appropriate to use free-recall questions to measure students’ navigational performance.

Thirdly, the instructional material of the training program should be organised, based on the aim and the instructional approach. The traditional face-to-face instructional approach was chosen in the present study in order to increase interactions amongst the teacher and participants. Also, this approach can maximise opportunities for NESB students to clarify any confusion with the teacher. It is suggested the instructional material should be presented clearly and logically. An overview of the instruction should be followed by definitions of selected strategies, teachers’ explanations and examples of applying such strategies. The instruction should be finished with a brief review of what has been taught.

Furthermore, goals of the training program also define the selection of various reading comprehension strategies. The present study selected cognitive strategies, metacognitive strategies, and hypertext comprehension strategies, based on conclusions and recommendations from previous studies. If the training program intends to improve students’ navigational performance, linking selection strategies should be included in the training program. If blogs and wikis are used
for educational purposes, socio/affective strategies should also be taught to students.

8.4.2 The delivery of the training program

The delivery of the training program should follow instructional principles and theories. The present study recommends DES principles by Duffy (2002) and the First Principle of Instruction by Merrill (2002). DES principles (Duffy 2002) provide instructional guidelines for teaching students reading comprehension strategies. The First Principle of Instruction (Merrill 2002) aims at directing teachers to deliver instructions effectively.

DES principles (Duffy 2002) suggest that reading comprehension strategies should be taught to students directly, along with adequate examples that match their levels of vocabulary and prior knowledge. In order to deliver the training program successfully, teachers should provide an overview of the instruction, explain strategies in detail, offer opportunities to practice various strategies, and recap key concepts at the end of each class. Revision and reading comprehension exercises are key issues that lead to students’ success in mastering newly learnt strategies and improving their reading comprehension skills.

The First Principle of Instruction (Merrill 2002) argues that every instructional activity should include activation, demonstration, application and integration. The core task of the training program defines the implementation of the above four activities. Merrill (2002) also emphasises the importance of revision and application of new knowledge. In particular, he suggests the importance of integrating new knowledge into students’ current knowledge bases and skill sets.

According to Duffy (2002) and Merrill (2002), the language used in the training program, the exercises, and the revision, are three key factors that determine the
success of a training program. First, the present study recommends that the language used in the training program should match NESB students’ levels of the English language and their prior knowledge of selected topics. Oral explanations should be given to students in plain, clear English; and teachers should also select adequate examples to illustrate selected strategies. In order to enhance students’ sense of participation, class discussions should be organised for students’ to exchange their opinions and experiences using reading comprehension strategies.

Secondly, well-planned exercises should be given to students in each training session. It is recommended that the number of tasks that students are required to complete should be increased as the training program continues (Duff 2002; Merrill 2002). Meanwhile, teachers’ supervision and coaching should decrease, in order to improve students’ independence and proficiency in applying strategies.

Thirdly, revision of strategies is of great importance. Revision allows students to recap key concepts involved in the training program, as well as leads to students’ better understanding of the strategies they have learnt. The present study suggests that revision of strategies should be delivered to students in training sessions, before they start accomplishing reading comprehension tasks. The revision becomes shorter and shorter as it is assumed that students will become proficient as the training program carries on (Duffy 2002; Merrill 2002).

Recommendations made in this chapter are based on results of the present study, as well as conclusions and suggestions of prior studies. The following chapter will conclude the present study and disclose limitations of the present study.
Chapter 9

Conclusions. Limitations. Future Avenues.

So far, the current study has been completely presented, including aims, hypothesis, the research methodology, results, discussion and recommendations. This chapter concludes the present study according to research findings and related discussions. Also, limitations of the present study are presented, followed by a discussion of possible future areas of research studies.

9.1 Conclusions

The present study has explored the influence of reading comprehension strategy training on NESB students’ hypertext comprehension performance, and compared the effect of hypertext, with linear and hierarchical structures, on NESB students’ comprehension of hypertexts. The results of the present study confirmed that a well-planned reading comprehension strategy training program which includes teaching cognitive, metacognitive and hypertext reading strategies, could lead to an increase in NESB students’ hypertext comprehension performance. This finding is in line with prior conclusions made by a number of researchers and scholars. Meanwhile, the results also suggest that linearly structured hypertexts can lead to a better hypertext comprehension outcome by NESB students, in comparison with using hierarchically structured hypertexts. This finding parallels a number of previous conclusions, but it also contradicts some others. Reasons for such contradictions have been explained in detail in Chapter 7.

Therefore, two major conclusions of the present study are:

- Reading comprehension strategies should be taught explicitly to
post-secondary NESB students to enhance their comprehension of online learning materials;

- The linear structure should be used for organising and presenting online learning materials for NESB students, in order to reduce disorientation and cognitive overload.

These two conclusions are elaborated on Section 9.1.1 and Section 9.1.2.

9.1.1 The importance of providing NESB students with explicit reading comprehension strategy training

One research finding of the present study indicates that well-planned reading comprehension strategy training can lead to the improvement of NESB students’ hypertext comprehension performance. Based on this finding, it can be concluded that teaching NESB students to comprehend educational hypertexts is of great importance.

Prior studies have indicated the importance of teaching reading comprehension strategies to students in the context of comprehending hypertexts and e-learning, across all educational sectors. These studies have reached a sound conclusion that reading comprehension strategy instructions increase students’ hypertext reading comprehension performance. Examples of such studies include Verezub et al. (2008), Munro and Verezub (2011), and Shen and Liu (2011).

As more and more international students come to Australia to continue their education, it becomes vital to teach students from non-English speaking backgrounds reading comprehension strategies. This helps to overcome possible difficulties, while they try to comprehend learning materials written in English. Potential difficulties in hypertext comprehension can be created by disorientation, lack of prior knowledge of selected topics, and deficiency in the English language (Tindale 2005). There are a number of prior studies that have
highlighted the importance of teaching NESB students to comprehend texts, in particular hypertexts, metacognitively. For instance, Anderson (2003) and Konishi (2003) both emphasised the importance of this. However, they made this argument based on qualitative data. In other words, this argument is not necessarily justified by quantitative data. Wichadee (2011) conducted a study to explore the influence of metacognitive strategy training for Thai students. An extensive training program was included in this study. The conclusion of this study confirmed that reading comprehension strategy training could increase NESB students’ reading comprehension performance. Nevertheless, participants in this study were asked to comprehend print-based texts instead of hypertexts. Shen and Liu (2011) established a website specifically for online metacognitive strategy instructions. Their conclusions revealed that online metacognitive strategy training could enhance NESB students’ ability to plan and monitor while comprehending hypertexts. However, Shen and Liu (2011) maintain that the design of this particular website was not sophisticated, so that their initial aims were not achieved.

In order to help NESB post-secondary students improve their understanding of online subject-matter learning materials, a well-designed reading comprehension strategy training program was used in the present study. Chapter 5 has presented an extensive overview of the research design and instruments included. The design of hypertexts and instructional materials was based on existing theories and principles (e.g. Hermad 1997; Brown and Parlinscar 1989). The overall delivery and instructional procedures of the training program followed instructional principles proposed by Merrill (2002) and Duffy (2002). Literal questions, inferential questions and critical questions were employed to measure participants’ hypertext comprehension performance.

The results of the present study indicated that NESB students’ hypertext comprehension performance has been significantly improved by a reading
comprehension strategy training program. This particular finding parallels a number of prior conclusions of researchers, including Verezub et al. (2008), Azevedo and Cromley (2004) and Wichadee (2011). In particular, this research finding fills a gap in the research literature related to teaching post-secondary students from non-English speaking backgrounds to comprehend online learning materials. It confirms that NESB students should be taught various reading comprehension strategies explicitly, in order to assist them in comprehending online learning materials. As recommended in Chapter 8, this particular reading comprehension strategy training program should be thoughtfully incorporated into mainstream subjects, so as to improve NESB students’ learning outcomes. This recommendation was extracted from the analysis of post-test questionnaire data, as well as conclusions of previous studies (Sanchez-Alonso & Vovides 2007). The post-questionnaire data of the present study reveals that over 95% participants believe that the reading comprehension strategy training they received was helpful, and would apply these strategies in the future to comprehend their subject-matter materials.

Instructional approaches are critical elements in reading comprehension strategy training. The present study employed a conventional face-to-face instructional approach, in order to enhance participants’ sense of participation and interactions with peers. Prior studies have suggested using computer-based, and/or web-based strategy training interventions, to convey strategy instructions. This suggestion parallels trends and expectations in the domain of education, since more and more of the latest technologies have been utilised for educational purposes. If these interventions are used in practice with adequate technological support, it is possible to benefit a larger number of NESB students, regardless of their geographical positions. However, using computer-based, and/or web-based reading comprehension strategy training interventions would demand sophisticated design and delivery. Otherwise, potential advantages of such interventions could be limited.
The present study also compared NESB students’ performance when they comprehended hypertexts with linear and hierarchical structures, before and after the training. The next section concludes the research finding from this perspective.

9.1.2 The influence of two different hypertext structures

Another research finding of the current study is that NESB students who comprehend linearly structured hypertexts outperform those who comprehend hierarchically structured hypertexts. Therefore, it can be concluded that linearly structured hypertexts can lead to better hypertext comprehension performance by students from non-English speaking backgrounds.

Previous studies have compared the effects of hypertext structures on students’ hypertext comprehension performance. However, conclusions reached by these studies are not consistent with each other. McDonald and Stevenson’s (1996;1998) influential studies have indicated that students’ learning outcomes are better when interacting with linearly structured hypertexts, than when interacting with hierarchically structured hypertexts. This conclusion is supported by Al-Seghayer’s (2005;2007) and Martin’s (2008) conclusions. Although hypertext systems used in these studies varied, it is still acceptable to argue that linearly structured hypertexts can result in greater hypertext comprehension performance in comparison with hierarchically structured hypertexts.

Waniek et al’s (2003) research findings contradict the above conclusions. It was indicated that students who comprehended hierarchically structured hypertexts surpassed those who comprehended linearly structured hypertexts. However, it should be noted that Waniek et al. (2003) provided structure overviews of hierarchically structured hypertexts, so that participants knew exactly where they were, and where they were going to while reading. The provision of structure
overviews could help to reduce disorientation, which may have affected the final results. Another issue that should be taken into account is that Waniek et al. (2003) did not specify if their participants comprehended hypertexts written in English or in their mother tongue (German).

As discussed in Chapter 7, this finding of the present study is consistent with a number of prior studies, while contradicting others. The current research finding is consistent with McDonald and Stevenson’s (1996;1998), Al-Seghayer’s (2005;2007) and Martin’s (2008) conclusions. Amongst these studies, Al-Seghayer (2005;2007) recruited NESB students as participants, while McDonald and Stevenson’s (1996;1998) and Martin’s (2008) participants were from English speaking backgrounds. Moreover, reading comprehension strategy training was not included in any of the above studies.

The research finding of the present study confirmed that NESB students can obtain a better understanding of hypertexts when linearly structured hypertexts are used. This finding fills another gap in the existing literature; that is, linearly structured hypertexts should be used for educational purposes when working with students’ from non-English speaking backgrounds. Hierarchically structured hypertexts can also be used for NESB students. However, it requires careful planning and thoughtful design of hypertexts and instructions. As recommended in Chapter 8, the Cognitive Load Theory should be given special attention when employing hierarchically structured hypertexts for educational and instructional purposes.

Based on the above conclusions, the present study has made two major contributions. The following section elaborates on these two contributions in detail.
9.1.3 Contributions of the present study

Two major contributions of the present study include:

- Recommending a reading comprehension strategy training program designed specifically for NESB students;
- Consolidating the effectiveness of a number of theories and principles in the context of working with NESB students.

Chapter 8 has recommended a teaching methodology in terms of reading comprehension strategy training for NESB students based on research findings of the present study. As discussed in Chapter 8, both design and delivery of this particular reading strategy training program should be carefully planned in order to maximise benefits of the training. The results of the present study have confirmed the effectiveness of such a training program in terms of helping NESB students improve their comprehension of online subject-matter materials. Also, the participants’ positive attitude to the training program reflects the need to offer reading comprehension strategy training to NESB students, to assist them in overcoming possible difficulties when comprehending online learning materials. It seems reasonable to suggest that cognitive strategies, metacognitive strategies and hypertext reading strategies should be taught to post-secondary NESB students. The post-test questionnaire data revealed that some participants had learnt a number of cognitive strategies before they came to Australia. However, they were not able to properly name these strategies in English. Thus, it is essential to review, and/or remind students, of cognitive strategies.

The design and delivery of this particular reading comprehension strategy training program followed a number of existing theories and principles. These theories and principles were reflected in the design of hypertexts, the design of instructional materials, the design of hypertext comprehension tasks, as well as the delivery of the training program. These theories and principles were originally
developed and refined in an English-speaking environment. Prior to the present study, researchers and scholars employed these principles to design hypertexts and instructions for students from an English speaking background. In the present study, NESB participants came from diverse language and cultural backgrounds. The results of the current study confirm that these theories and principles can be used when working with students from non-English speaking backgrounds.

In general, the present study contributed a reading comprehension strategy training program template for teachers who work with post-secondary NESB students to improve their comprehension performance of online materials. Besides post-secondary management subjects, this strategy training program can be incorporated into other mainstream subjects, to reduce potential difficulties experienced by NESB students.

However, the present study has some limitations. They are discussed in the following section.

9.2 Limitations

Limitations do exist in the present study, including the exclusion of multimedia content, and the solo instructional approaches used in the training program. These limitations are elaborated on Section 9.2.1 and Section 9.2.2.

9.2.1 The exclusion of multimedia content

Although the present study tends to use “hypertext” and “hypermedia” interchangeably, information contained in hypertexts used in the present study was purely written texts. Multimedia content, such as pictures, animations, audios and videos, was not used. In fact, contemporary students would encounter the above online multimedia content every day. In this regard, it would
be important to teach students, in particular NESB students, to deal with such online information appropriately.

The initial purpose of the current study was to teach students from non-English speaking backgrounds to comprehend online texts using a suite of reading comprehension strategies. Therefore, the measurement of their reading comprehension performance of online texts is at the core of the present study. The inclusion of online multimedia content could increase participants’ cognitive load and opportunities for disorientation. The use of audios and videos in hypertexts would require the training of listening comprehension strategies for NESB students. Hypertexts that involve only written texts can help participants avoid becoming overwhelmed in the instruction, and/or disorientated, while reading hypertexts.

9.2.2 The instructional approach used in the present study
The present study employed a traditional face-to-face instructional approach to deliver the reading comprehension strategy training program. The research findings have indicated the effectiveness of such a program. As functions of blended learning and e-learning are increasingly addressed, it is critical to test the validity of this strategy training program in a blended learning and e-learning environment.

The traditional face-to-face instructional approach was used in the present study, in order to maintain students’ participation in classes, and provide instant supervision for participants whenever necessary. However, the maximum number of students allowed in each session is relatively limited in comparison with the large number of learners that blended learning and e-learning could reach.
The above limitations of the present study lead to avenues for future studies. The following section presents a number of possible future areas for studies in the context of e-learning.

9.3 Future avenues

This section discusses the possibilities of future studies from the following perspectives:

- Enhancing NESB students’ listening comprehension skills;
- Enabling reading comprehension strategy training to reach a broader body of NESB students with the support of educational technology.

These possibilities are elaborated on Section 9.3.1 and Section 9.3.2.

9.3.1 Enhancing NESB students’ listening comprehension skills

As mentioned in Section 9.2.1, the inclusion of online multimedia content for educational purposes, such as audio clips and video clips, would challenge NESB students’ listening comprehension skills. Prior studies have suggested that NESB students are more competent in reading and writing than in speaking and listening. Therefore, in order to help NESB students to interact with online learning materials effectively, it becomes vital to teach them listening comprehension strategies in future studies. Listening comprehension strategies would not only enhance NESB students’ hypermedia learning outcomes, but also improve their understanding of lectures. Mulligan and Kirkpatrick (2000) argue that a large number of NESB students experience difficulties in terms of capturing and comprehending key information in lectures. If NESB students are given specific training on listening comprehension strategies, their academic performance in the era of technology-enhanced learning could be significantly improved.
9.3.2 Enabling reading comprehension strategy training to reach a broader body of NESB students with the support of educational technology

Section 9.2.2 discussed a disadvantage of the conventional face-to-face instructional approach used in the present study. In order to reach more NESB students, the reading comprehension strategy training could be conducted in a blended learning and e-learning environment. However, the plan, the design and the delivery of such a web-based training program would require a substantial amount of work for teachers. As discussed in Chapter 8, students’ participation, teachers’ supervision, and communication amongst teachers and students in an online learning environment, need to be well planned. Otherwise, the potential benefits of the online reading comprehension strategy training could be degraded.

As mobile phones enable users to connect with the Web, contemporary students may be able to get access to their online learning materials via their personal mobiles. Mobile learning is an area that is attracting more and more attention in the spectrum of education. In the future, it could be possible to incorporate reading comprehension strategy training into mobile learning, in order to help NESB students overcome possible difficulties brought about by constantly upgraded technology.
References:


Azevedo, R & Cromley, JG 2004, 'Does Training on Self-Regulated Learning
Facilitate Students' Learning With Hypermedia?', *Journal of Educational Psychology*, vol. 96, no. 3, pp. 523 - 535. EBSCOhost,


Lee, M & Baylor, AL 2006, 'Designing Metacognitive Maps for Web-Based


Mazzali-Lurati, S 2007, 'Here is the author! Hyperlinks as constitutive rule of hypertextual communication', *Seniotica*, vol. 167, no. 1/4, pp. 135 - 168.


McNamara, DS, Kintsch, E, Songer, NB & Kintsch, W 1996, 'Are good texts always better? Interactions of text coherence, background knowledge, and levels of understanding in learning from text', *Cognition and Instruction*, vol. 14, no. 1, pp. 1 - 43.


Nelson, TH 1965, 'A file structure for the complex, the changing and the indeterminate' ACM 20th National Conference, Cleveland, ACM, pp. 84 - 100.


O'Reilly, T & McNamara, D, S. 2007, 'Reversing the reverse cohesion effect: Good texts can be better for strategic, high-knowledge readers', *Discourse Processes*, vol. 43, no. 2, pp. 121 - 152.


Price, L & Kirkwood, A 2010, 'Technology enhanced learning - where's the


Rovai, A 2002, 'Building sense of community at a distance', International Review of Research in Open and Distance Learning, vol. 3, no. 1


Sanchez-Alonso, S & Vovides, Y 2007, 'Integration of metacognitive skills in the
design of learning objects', *Computers in Human Behavior*, vol. 23, no., pp. 2585 - 2595.


Snow, CE 2002, *Reading for Understanding Toward an R and D Program in Reading Comprehension*, RAND Santa Monica.


Strampel, K & Oliver, R 2008, 'We've thrown away the pens, but are they learning? Using blogs in higher Education', in *Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008*, pp. 991 - 1001.


Sutherland-Smith, W 2002a, 'Weaving the literacy Web: Changes in reading from page to screen', *The Reading Teacher*, vol. 55, no. 7, pp. 662 - 668.


Thomas, P, King, D & Minocha, S 2009, 'The effective use of a simple wiki to support collaborative learning activities', *Computer Science Education*, vol. 19, no. 4, pp. 293 - 313.

Thorndike, EL 1917, 'Reading as reasoning: A study of mistakes in paragraph reading', *The Journal of Educational Psychology*, vol. 8, no. 6, pp. 323 - 332.


Vellutino, FR 2003, 'Individual differences as source of variability in reading comprehension in elementary school children', in A. P. Sweet and C. E.


Waniek, J & Schafer, T 2009, 'The Role of domain and system knowledge on text comprehension and information search in hypermedia', *Journal of Educational Multimedia and Hypermedia*, vol. 18, no. 2, pp. 221 - 240.


Williams, JB & Jacobs, J 2004, Exploring the use of blogs as learning spaces in


Appendix I The evidence of ethic clearance

To: Dr Vanessa, 112 International Mt Lawley
CC: Dr Sharon Grant, MRE, Dr Martin Mitchall, MRE

Dear Dr Vanessa,

SURFEC Project 2003/156 The influence of comprehension strategies employed reading by students from non-English speaking background

Annexed Information: ID1000 (2000 to 31/07/2000, Updated)

I refer to the ethical review of the above project protocol undertaken on behalf of St Vincents Hospital Research Ethics Committee (SVREC) by SURFEC Sub-Committee (SMRSC) at a meeting held on 30 July 2003.

Your responses to the review, as emailed on 12 August 2003, which accompanied email response received on 2 August 2003, went out to a SMRSC delegate for consideration.

I am pleased to advise that, as submitted to date, the project has approval to proceed in line with standard on-going ethics clearance requirements.

- All human research activities undertaken under St Vincents auspices must conform to St Vincents and external regulatory standards, including the National Statement on Ethical Conduct in Human Research and with respect to access, data use, retention and disposal.

- The named St Vincents Chief Investigator (SURFEC) remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and control procedures or instruments approved. Any change in chief investigator requires the investigation by the SMRSC.

- The above project has been approved for ethical review by the ST Vincents Human Research Ethics Committee (STVREC). The status of approved procedures or instruments remains one of ethical approval and, therefore, SMREC must be notified immediately or as soon as possible, therefore if (a) any adverse or unexpected adverse effects on participants and any remedies; or (b) proposed changes in protocols; and/or (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as all the conclusions (or abandonment) of the project.

- A site inspection either at the project site or at the stand alone site at any time.

Please contact me if you have any queries about on-going ethics clearance, citing the SURFEC project number. Please retain a copy of this clearance email as part of project records.

Best wishes for the project.

Ivan Goldenberg
Surfeco Project Manager
Appendix II The Statement of fulfilling ethic clearance

The author hereby states that all conditions pertaining to the clearance were properly met in the progression of the experiment. All participants signed consent forms after reading the consent statement. Also annual reports have been submitted.
Appendix III The instructional material

See Overleaf
Appendix IV A screen shot from the pre-test webpage (Linearly structured hypertexts)
Appendix V Screenshots from the post-test webpage (Hierarchically structured hypertexts)

Session 7

Knowledge Management, Mentoring and Organisational Learning

Knowledge management (KM) is an essential approach to conduct organisational learning (OL). KM is about knowledge creation, storage and knowledge sharing. A knowledge community should be involved in a successful KM system. A knowledge community is where people interact in the discovery and use of knowledge. These are human interactions that enable the knowledge generation, storage and consumption. Knowledge retention is vital for KM. Once experienced employees resign or retire, it is always a hard time for new or less experienced employees. Thus, mentoring programs are used as a tool to pass on knowledge in firms.

Mentoring is a knowledge sharing channel. New or less experienced employees are able to learn with experienced ones through it. Mentoring is also an opportunity for new employees to learn organisational culture. There are two types of mentoring programs, known as formal and informal mentoring. Formal mentoring is organised by firms. It aims at supporting participants and providing formal training. Informal mentoring occurs when two or more people set up an informal developmental alliance. Informal mentoring contributes to knowledge sharing and utilisation. Formal mentoring results in knowledge sharing but not necessarily knowledge utilisation.

Main text
Session 7

Organisational learning

Organisational learning capability shows the importance of the facilitator factors for organisational learning. It could be defined as the organisation figure that enables a firm to learn. It requires the firms to deal with new ideas and suggestions, share ideas and opinions and exchange information across the firm. In this sense, organisational learning will be conducted successfully.

A sample of text links
Appendix VI Samples of comprehension tasks

The influence of comprehension strategies on hypertext reading by students from non-English speaking background

Session One

*Please read linearly structured hypertexts “Organisational Learning and Organisational Change” and answer the following questions in your own words:*

1. Why is organisational learning conducted?

2. How do you define policy learning?

3. Besides policy learning, what are other levels of organisational learning?
4. Can you explain how effectiveness and efficiency contribute to organisational learning?

5. Could you identify the interrelationship between learning organisation and organisational learning?

6. Can you find some connections between consumer behaviour and operational learning?

7. Why does technology development have influence on organisational change?

8. Why do you think being a learning organisation is important to contemporary companies?
9. In your opinion, what external factors can affect organisational learning?
The influence of comprehension strategies on hypertext reading by students from non-English speaking background

Session One

Please read hierarchically structured hypertexts “Organisational Learning and Organisational Change” and answer the following questions:

1. What are differences between the single-loop learning and the double-loop learning?

2. What are differences between the exploitation learning and the exploration learning?

3. Why are airline alliances considered to be a special format of strategic alliances?
4. What are the relationship between consumer behaviour and the exploitation learning?

5. In your opinion, what influences the formation of organisational culture?

6. Besides the change and turbulence occurred in the world, what other factors drive inter-organisational learning?

7. Why do you think information and communication technology fosters organisational change?
8. Why is understanding consumer behaviour essential to an e-business company?

9. What are the possible reasons for double-loop learning advantages over the single-loop learning in organisational learning?
Appendix VII The post-test Questionnaire

The influence of comprehension strategies on hypertext reading by students from non-English speaking background

Questionnaire

1. Level of Education: ---------
2. Countries of origin: ---------
3. Languages spoken at home: ---------------------------------
4. Degree you are undertaking: ------------------------
5. Years of English Study: -------------------------------

6. (a) Had you learnt any reading strategies before you came to Australia?
   □ Yes
   □ No
(b) If yes, please tick strategies you have learnt:
   □ Summarising
   □ Paraphrasing
   □ Predicting
   □ Visualising
   □ Making connections

7 (a) Do you often reading hypertexts?
   □ Yes
   □ No
(b) If yes, which type of text do you prefer reading?
   □ Hypertexts
Traditional print texts

(c) Why do you prefer reading that type of texts?

8 What strategies did you use when reading hypertexts?
- Summarising
- Paraphrasing
- Predicting
- Visualising
- Making connections

9. What strategies did you use during training when comprehension failed?
- Planning
- Monitoring
- Evaluating
- Reviewing

10. Did training help you improve reading comprehension?
- Yes
- No

11. Will you use reading strategies when reading hypertexts in the future?
- Yes
- No
List of publications

During the PhD candidature, I have three academic paper published:


The Paper was the ISANA Bursary Winner.
Hypertexts and Reading Comprehension Strategies

Wang Hua
What are we doing today?

Today we will be learning:

- Cognitive strategies
- Metacognition and Metacognitive strategies
- Hypertexts
- How to read hypertexts properly;
- What we are doing next week.
What are Cognitive Strategies?

- **Summarising**: To generate main ideas of what we have read.
- **Paraphrasing**: To re-phrase what we have read in our own words.
- **Visualising**: To draw mental pictures/images of what we are reading.
- **Predicting**: To forecast the possible outcome of what we will read.
- **Making connections**: To link what we are reading to our previous knowledge.
What is Metacognition?

- It refers to our mental activities that take the control over our own thinking processes.

- We could apply metacognition in our daily learning, such as reading.
What metacognitive strategies do we use?

- Clarify our purposes of reading;
- Recall our background knowledge and link it to the new information in the text;
- Focus on the major content;
- Evaluate how much background knowledge we have used;
- Monitor our reading processes and detect comprehension failures;
- Adjust cognitive strategies if comprehension does not happen.
An exercise

Please identify the main idea(s) of the following text by using metacognitive strategies:

Each organisation has a distinct purpose. This purpose is typically expressed in terms of a goal or a set of groups that the organisation hopes to accomplish. Also, an organisation is composed of people. One person working alone is not an organisation, and it takes people to perform the work that is necessary for the organisation to achieve its goals. Furthermore, all organisations develop some deliberate structure so that their members can do their work. That structure defines relationships among all members, as well as duties and responsibilities.
The main idea of the previous text is:

An organisation is an entity that has a distinct purpose, includes people and has some type of deliberate structure.
Discussion

● What strategies did you use?

● Did the strategies you used work for you?

● If you did not get the answer correct in the first time, did you use your metacognition to correct your mistakes?
What are Hypertexts?

Hypertexts:

- Are Computer-based;
- Have electronic links;
- Contain multimedia contents, such as pictures and video clips (such as YouTube);
- Could be in a linear fashion, in a hierarchical fashion, or in a referential fashion.
How should we read hypertexts?

- Try to identify keywords in each link;
- Open each link in a new window or a new tab to keep you aware of your current position;
- Connect contents in individual links to main texts;
- Connect contents of links to each other;
- Try to use various cognitive strategies, such as summarising and paraphrasing, to achieve comprehension;
- Use metacognitive strategies to get our reading processes organised and under control.
What are we doing in the next session?

- Discussing activities from Session 1.
- Starting to use various reading strategies collaboratively.
- Reading hypertexts with the help of these strategies.
- Assessing our comprehension performance by answering questions after reading.