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**UNIVERSITY OF SOUTHAMPTON**

FACULTY OF HUMANITIES

DEPARTMENT OF MODERN LANGUAGES

ACADEMIC DIGITAL LITERACY: comprehension reading strategies of international  
postgraduate students in a UK educational context during the digital era

by

**Hanadi Abdulrahman Khadawardi**

Thesis for the degree of Doctor of Philosophy

May 2016



## **ABSTRACT**

This study contributes to the existing body of research on academic reading practices in the 21<sup>st</sup> century, by focussing on on-screen reading in the technological age. The study offers an insight into the nature of on-screen reading, and reflects the authentic on-screen academic reading experiences of international postgraduate (five Master's and fifteen PhD) Saudi readers in the UK educational context. This was achieved by investigating participants' reading comprehension processes and strategies while reading on-screen academic research articles, compared with those employed when engaged in print-based reading. This study also scrutinises L2 readers' use of digital affordances and their on-screen academic reading challenges. A further objective was to examine students' preferences and perceptions of both reading formats.

Case study and interpretive qualitative approaches have been adopted in the present research study. Process oriented techniques, namely demographic questionnaires, think-aloud protocol, field notes, stimulated recall and interviews have been employed to collect the data. Thematic and content analysis; and a constant comparative method (CCM) have been applied to analyse the data.

The findings of this study suggest that in order to achieve effective on-screen reading, multiple literacies are required, and this includes a newly identified digital academic strategy literacy (DASL). The research also indicates that although readers develop capabilities over time, readers are not confident enough in their digital literacies to practise on-screen academic reading regularly. Not only did many of the readers in this study lack sufficient competences and capabilities in digital literacies to derive benefit from the advantages of on-screen reading, they were also not able to interact with on-screen text as they would do with printed text. Readers' preferences for reading printed rather than on-screen text, their L1 and L2, their discipline and/or individual differences might contribute to their on-screen reading interactions.

Although new on-screen reading strategies emerged from the data, the results, in the main, reveal a transfer of print-based reading techniques to on-screen reading. This demonstrates a move from a traditional literacy to a digital one in which readers manipulate the strategies that they are already aware of, and are capable of, in order to read a text on-screen. Surprisingly, readers were much more effective; and employed more strategies and interacted more deeply with printed text than with on-screen text.

The results from this study have led to the proposal of suggested models for interpreting on-screen L2 academic reading interactions. A number of pedagogical practices are suggested and recommended for preparing L2 readers for further academic study; and these also could be equally applicable and useful for L1 academic reading lessons in the 21<sup>st</sup> century, including reshaping reading skill textbooks to accommodate and meet the needs of reading comprehension practices in the technological age and promoting learners' digital academic strategy literacy. These may be useful to teachers when teaching on-screen reading strategies for specific academic purposes in digital universities.



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# DECLARATION OF AUTHORSHIP

I, Hanadi Abdulrahman Khadawardi declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

ACADEMIC DIGITAL LITERACY: comprehension reading strategies of international postgraduate students in a UK educational context during the digital era

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published as: Khadawardi, H. 2014. A study of On-screen Academic Reading Strategies among a Group of EFL/ESL Postgraduate Arab Learners in a British University. In *International Conference Proceeding, Pixel association, ICT for language Learning*. Italy, Florence, pp.531-535

Signed: .....

Date:.....



## Acknowledgements

Firstly, I would like to express my sincere gratitude and appreciation to my admirable supervisor Professor Vicky Wright for her continuous support throughout my Ph.D. study at the University of Southampton, for her endless patience, kindness, motivation, immense knowledge, guidance and expertise. I could not have imagined having a better supervisor for my Ph.D. study and without her this thesis would not have been completed or written.

Besides my supervisor, I would like to thank my advisor, Dr. Karin Zotzmann for her insightful comments and encouragement, but also for her questions, which encouraged me to widen my research from various perspectives. I would also like to extend my thanks to my internal examiner Dr. Alasdair Archibald, whose constructive feedback during my upgrade Viva modified and added weight to the significance of my study. Special thanks to Professor Rosamond Mitchell for her advice and constructive feedback on writing my PhD research study proposal during her supervision of my Master's dissertation.

I am also grateful to have been able to carry out my PG study in the supportive environment of the University of Southampton. I have had the chance to attend several training sessions and workshops; and to work part time, which all added to my knowledge and experience and contributed to the achievement of my goal.

I also owe a debt of gratitude to the research participants who gave up so much of their time to take part in this research. Without them this thesis would not be the same. My gratitude is also extended to King-Abdul-Aziz University which has provided me with a four year full time scholarship, enabling me to undertake this research. Also, I am grateful for assistance received from the Saudi Cultural Bureau in London throughout my stay in the UK.

Words cannot express how I am grateful to my family who have always been there for me. Special thanks to my encouraging father who was the source of my strength and motivation to challenge all the difficult situations that I experienced and to finish this thesis; and to my caring mother for her love and prayers. I would like also thank my brothers and my sister for supporting me spiritually throughout the writing of this thesis and my life in general.

My sincere thanks go to my colleagues and friends in Southampton who supported me during the writing of this thesis, and encouraged me to strive towards my goal. I am thankful for their guidance, invaluable constructive criticism and friendly advice during my PhD. I am sincerely grateful to them for sharing their honest and illuminating views on a number of issues related to my research study.

*Lastly, I would like to dedicate this PhD thesis to my two lovely daughters who I always carry in my heart, Yomna and Reema*



# Definitions, Abbreviations and Transcription Conventions

## *DEFINITIONS*

The following definitions and abbreviations of the following terminologies, presented in alphabetical order, were used in this study

### **ACADEMIC READING PREFERENCE**

This refers to the reader's selection of reading formats in a particular context; when reading either an electronic or printed academic paper (see 6.5.5).

### **COGNITIVE APPROACH**

This study defines cognitive approaches as mental actions that include a wide range of processes and strategies employed by individuals, either consciously or unconsciously, to achieve specific purposes (see 2.6.1).

### **COMPREHENSION**

Comprehension in this study refers to the reader's ability to derive meaning from text by understanding the surface level of ideas and continuing to understand the deeper meanings including comprehending information and language. It also involves connecting the ideas that are presented and conveyed in a text by using different sorts of schemata; digital, formal and content (competences) and employing reading approaches including reading comprehension strategies and digital affordances (capabilities) (see 2.5.3).

### **DIGITAL ACADEMIC STRATEGY LITERACY (DASL)**

Digital academic strategy literacy (DASL) is established and defined in this study as the competences and capabilities required to use a group of digital strategies (elements of different literacies) that enable readers to read text for academic purposes on-screen. It is about having the knowledge and capabilities to interact with text on-screen. This could be for a wide range of purposes, such as comprehension or for fact-finding (see 2.3.1).

### **DIGITAL LITERACY**

The proposed definition of digital literacies in the current study is a group of adaptable and transformative literacies that enable individuals to effectively engage, communicate and achieve objectives successfully and fluently online. Digital literacies refer to the awareness, the

capabilities to practice and the attitude, behaviour, skills, confidence and fluency necessary to interact effectively with digital resources and to solve comprehension problems. It includes decoding and encoding texts, accessing networks, collecting information, analysing, sorting, communicating and engaging (see 2.3). It is not only one specific sort of literacy, instead; it involves multiple literacies on a broad spectrum that are associated with and complement each other. One of the literacies that is associated with on-screen reading and essential for 21st century students is digital academic strategy literacy (DASL).

### **DIGITAL SCHEMATA**

Readers require new forms of schema, namely knowledge of how to interact with digital text presented on-screen, and to be able to make use of e-text resources to enhance their on-screen reading comprehension (see 2.6.3).

### **DIGITAL TEXT**

Texts that are viewed via different sorts of electronic devices, using two different formats: hypertext and/or static (Ketabi et al. 2012).

### **E-TEXT RESOURCES**

The digital affordances that are available during the reading of text on-screen (see 2.5.5)

### **FUNCTIONAL READING STRATEGIES**

Groups of strategies employed for different purposes, such as problem-solving, support, critical and global functional strategies (see 3.9.2, Table 3, p.128).

### **READING**

Reading in this study is viewed as the act of interacting with a written text to achieve specific purposes. It is thus a complex cognitive social activity that involves either a printed and/or electronic text, requires different sorts of schemata (competences) and is achieved via different processes (capabilities) and strategies (see 2.4.1).

### **LITERACY**

The competence and the capabilities to read, write and communicate socially (see 2.3).

### **ON-SCREEN ACADEMIC READING**

Reading on-screen in this study is defined as the act of interacting with an e-text presented through electronic screens using digital strategies and e-resources to achieve specific purposes. It

requires competences (schemata), particularly digital schema; and capabilities, to enhance digital reading comprehension and to solve digital academic reading challenges (see 2.5).

#### **PRINT-BASED READING**

The approaches employed by readers to interact with text printed in a traditional paper format.

#### **READING PRACTICES**

The strategies, processes, styles and behaviour employed to read and during reading.

#### **READING PROCESSES**

The different ways in which readers approach the text (either top-down and/or bottom-up) (see 2.6.1).

#### **SUB-READING STRATEGIES**

The wide range of reading strategies that constitute the different reading strategy functions: problem-solving, support, critical and global sub-strategies (see Appendix I, Table 16, p.338 for sub-strategies explanation and examples).

(Continued overleaf)

*ABBREVIATIONS USED*

<b>CRT</b>	<b>Critical Reading Strategies</b>
<b>DASL</b>	<b>Digital Academic Strategy Literacy</b>
<b>DL</b>	<b>Digital Literacy</b>
<b>EFL</b>	<b>English as a Foreign Language</b>
<b>ESL</b>	<b>English as a Second Language</b>
<b>FN</b>	<b>Field Notes</b>
<b>IL</b>	<b>Information Literacy</b>
<b>Intvw</b>	<b>Interview</b>
<b>ISA</b>	<b>Independent Strategy Application</b>
<b>GLOB</b>	<b>Global Reading Strategies</b>
<b>L</b>	<b>Literacy</b>
<b>L1</b>	<b>Mother Tongue / First Language</b>
<b>L2</b>	<b>Second Language</b>
<b>LIH</b>	<b>Language Interdependence Hypothesis</b>
<b>LTH</b>	<b>Language Threshold Hypothesis</b>
<b>ORSSC</b>	<b>On-screen Reading Strategy Scheme</b>
<b>OSORS</b>	<b>On-line Survey of Reading Strategies</b>
<b>Ph1</b>	<b>Phase One of Data Collection</b>
<b>Ph2</b>	<b>Phase Two of Data Collection</b>
<b>PROB</b>	<b>Problem-Solving Reading Strategies</b>
<b>TA</b>	<b>Think-Aloud Protocol</b>
<b>SORS</b>	<b>Survey of Reading Strategies</b>
<b>SR</b>	<b>Stimulated Recall</b>
<b>SUP</b>	<b>Support Reading Strategies</b>

## TRANSCRIPTION CONVENTIONS

(.)	Brief pause	
(#)	Timed pause	
◦ ◦	Reduced volume soft voice (while reading)	
◦◦ ◦◦	Reduced volume whispered	(Ohta
2005)		
!	Exclamation	
/ /	<i>To separate between sequential events</i>	
[ ]	[in brackets means nonverbal behaviour ex. writing notes]	
<b>BOLD</b>	Bold words said in English language	
Full stop	End of the talk	
***	Not clear speech	
< = >	Two actions happening at the same time	
<b>CAPITALS</b>	<i>Words written by the participants</i>	
?	Asking a question	



# Chapter 1: **Digital academic literacy at university in the 21st century**

## **1.1 Introduction**

This chapter presents an overview of the research study and details the background and context, by discussing the status of reading comprehension in the digital age. It then identifies the rationale for the research, introduces the research aims, and outlines the main research questions, concluding with a brief summary of the structure of the thesis.

## **1.2 Reading comprehension in the digital era**

The commencement of the digital age has brought considerable change to educational sectors around the world, in particular the higher education sector in the UK, which has witnessed a proliferation of technology applications (Goodfellow & Lea 2013). Universities and colleges have digitised their management information systems and now use virtual learning environments, digital tools and materials to assist teaching and learning (Sharpe et al. 2010). Moreover, the increasing prevalence of digital libraries, including digital scholarly journals and publisher platform libraries, has brought dramatic changes to learning and knowledge related interactions in universities (Goodfellow & Lea 2013). Digitisation in colleges, universities and libraries has therefore changed the widely known concept of academic literacy, 'the ability to communicate competently in an academic discourse community' (Wingate 2015, p.6) to digital academic literacy (see 2.3 for further details). In this regard, a complete transition from writing on traditional paper to typing on-screen has occurred, while the transition from reading printed paper to on-screen remains incomplete (Mark 2015).

At the other end of the spectrum, English language as a medium of instruction and learning is a growing global phenomenon in the 21<sup>st</sup> century (Dearden 2014 & Robson 2013), the mastery of which is imperative to ensure information can be obtained, exchanged and communicated (Cenoz & Jessner 2000; Wood 2001). In light of this fact, many international students have opted to study in the West, particularly the UK, which after the United States is the most popular destination for international students to continue their studies. Each year, over 600,000 international students from 200 different countries come to study at schools, colleges and universities in the UK and a further

600,000 enrol on short English language courses (Robson 2013). A total of 216,466 study visas were approved in 2015 for non-EU nationals to study for undergraduate and postgraduate degrees, according to data from the Home Office (UK 2015). The number of non-UK students rises to 435,495 when EU students are included (UKCISA 2015).

These phenomena have had an enormous impact on second and foreign language students in academic contexts and on reading practice. The recent proliferation of academic electronic texts, e-resources and the increasing use of on-screen presentations has brought about dramatic changes in the ways in which university students interact and comprehend digital information (Liu 2008). Park et al. (2012) noted that university students increasingly read on screen as the use of digital libraries and electronic documents becomes normalised and learners spend a considerable amount of time reading documents electronically. Thus, the contemporary reading format differs considerably from that in preceding centuries. University students in the 21st century find themselves exposed to vast numbers of electronic texts and documents, on-screen facilities and resources provided by many UK universities (Goodfellow & Lea 2013), which require specific reading comprehension strategies. The above facts highlight the need to investigate and reconsider the reading practices of non-native readers of English in the digital age.

Several researchers have argued that the current reading digital environment requires new dimensions and approaches. For example, Darnton (2009), director of Harvard University Library, stated that readers today 'feel the ground shifting beneath their feet, tipping toward a new era that will be determined by innovations in technology' (p. xiii). Reading practices have changed due to advances made in computer technology and the digital environment. Globally, there has been an exponential growth in the amount of information available online in digital format; it is predicted that by 2020, about 70% of the world's information will be influenced by electronic practices (Eshet-alkalai & Geri 2009) As Liu (2005) noted, 'Digital media contributes to a transformative shift in reading' (p.701). In the current digital age, academic reading skills and technology are largely connected to academic contexts. The existence of digital libraries provides a useful example of recent academic reading behaviour. These libraries have been established to make data accessible and include vast amounts of digital information and electronic documents. The majority publish as well as purchase electronic texts (Brown 2001) . Many university libraries in the US and the UK offer access to a campus network, using Blackboard or WebCat to store electronic documents (Ibid.). Lynch (2001, cited in Brown 2001) also stated that publishers, such as the National Academies Press have been offering their publications free of charge on the Internet for several years.

Clearly, students' ability to read, interact, comprehend, evaluate and use electronic information effectively is a key concern and a necessity for success in the current digital age. Unfortunately, mastery of this skill is not easy, and many students encounter serious difficulties when attempting to effectively read and comprehend digital academic texts. Birkerts (1994, cited in Liu 2005) argued that readers lack the ability to interact and deeply engage with digital text. Liu and Huang (2008) commented, 'yet the practices of online reading in networked environments are not well understood' (p.623). These findings highlight the need for further research into on-screen academic reading comprehension in the academic setting, in this, the digital age.

It is now possible to argue that the rapid growth in information technology, access to diverse and disparate knowledge, the increased popularity of computer applications, the Internet, digital libraries and electronic academic texts in Western universities have led to an increased need to explore how readers read digital texts effectively. As the digital world has merged with academia, digital reading has consequently become increasingly common and important for both students and academics. Contemporary educational settings require students to locate digital information and to read, analyse, interpret, evaluate and use materials digitally. If students are not able to carry out these digital processes, they may encounter difficulties when attempting to function as literate students in a digital educational environment. It is thus essential to ensure that university students have the academic digital competences and capabilities to interact effectively with electronic academic texts and to enable readers to keep pace with digital changes.

### **1.3 Rationale of the study**

The starting point for conducting this research was the researcher's own experience as a postgraduate international Saudi student in the UK, which involved learning to read academic text and meeting the demands of a postgraduate course in a digital context. The researcher observed a large gap between the academic reading practices used in her previous educational context (Saudi Arabia) and the reading practices that have to be followed in order to succeed in the UK educational context. In Saudi Arabia, most academic reading practices were limited to reading printed material specified by subject tutors. In most academic disciplines, students study and read about their subject topic in Arabic (L1). Even when the subject curriculum is in English (L2), students' classroom instruction is principally in L1 (Liton 2013), which causes language interference problems and leads to heavy reliance on translation reading comprehension strategy (Khan 2012; 2011). Many Saudi students who intend to study postgraduate programmes have poorly developed English reading

comprehension skills, and struggle to read specialised materials (Al-Jarf 2005). Studying in such a context does not encourage the acquisition of the reading techniques necessary to enable readers to successfully achieve their academic goals. These include reading strategies, such as extensive, intensive and critical reading (Alqahtani 2011). This leads to the hypothesis that reading deficiency in the L1 may transfer to students' L2 digital academic reading and negatively affect their ability to take advantage of technological benefits while reading. They may experience difficulties in their L2 e-text interaction, as their first educational reading materials were mostly in Arabic (L1) and presented in traditional printed hard copy form.

Similarly, the significant increase in the number of Saudi students studying abroad, who are required to adapt to the new literacy demands of using another language in an immersion context, has heightened the need for this study to be conducted on Saudi students pursuing their studies in the UK. In 2005, the King of Saudi Arabia, Abdullah bin Abdul-Aziz, launched a King Abdullah Scholarship Program (KASP), to educate Saudi learners abroad. Since then, the number of Saudi students studying in Western countries has increased significantly. In 2005, the number of Saudi students in the UK totalled 1,200, with 2,625 in the USA, 1,250 in Canada and 309 in Australia. Saudi student numbers continued to increase and by 2012 had reached 21,193 in the UK, 86,123 in the USA, 17,468 in Canada and 12,606 in Australia (Ministry of Higher Education 2012). These numbers are expected to continue to rise as a result of the extension of the scholarship programme (KASP) until 2020 (Wagner 2012) (see 3.4 for further details about the context and the research participants).

Another important factor that increased the researcher's motivation and interest in conducting this study on non-native speakers of English in this study (Saudi) is that L2 university students face more difficulties in comprehending academic texts than their English-speaking counterparts (Cobb & Horst 2001). As English for Academic Purposes (EAP) researchers have indicated, second-language readers face linguistic barriers as well as challenges associated with their academic disciplines when aiming to understand written texts (Flowerdew & Peacock 2001; Francis & Hallam 2000). Kennedy (2001) also stated that, 'If individuals wish to enter the professional communities represented by the domains they study in, they will need access to both the knowledge and skills of the profession and the language and discourse through which those skills and knowledge are communicated, in this case English' (p.31). In response to this deficiency, this study aims to contribute to the body of research in the area of second/foreign language academic reading comprehension, and particularly the on-screen reading that is required in the current digital age.

Another important reason for this choice of research topic is that reading research is ignored in many ESL/EFL programmes, in which reading is considered an acquired skill requiring no explicit

instruction (Gambhir 1995). Dublin et al. (1986) argued that ‘haphazard reading instruction’ (p.37) might mislead students, directing them away from learning a correct way of reading; that is; they may acquire ineffective reading strategies, which could hinder their L2 reading comprehension.

This lack of knowledge or guidance has been transferred to research concerning digital reading. Most research into digital and learning skills has therefore focused on ESL/EFL students’ writing behaviour in the digital environment (for example Sullivan & Pratt 1996; Warschauer 2007; Li 2000; Braine 1997; Åkerfeldt 2014; Davis et al. 2014; Martin & Lambert 2015; Sinclair 2014; Millard 2014; Stapleton 2011), while digital reading strategies remain an underdeveloped area. The paucity of reading research has also extended into international students’ digital reading. Although some studies have examined the digital reading practices of international students (Chou 2012; Naumann 2015; James & de Kock 2013; Rose 2011), to the researcher’s knowledge, no studies have specifically investigated international students’ L2 digital academic reading practices in depth and particularly in the UK academic context.

These varied factors regarding L2 reading research, the unprecedented increase in international students studying at Western universities and the increasing popularity of computers and electronic academic texts make the aim of this study timely and significant, as they reveal the pedagogical importance of understanding on-screen academic reading and how a new form of literacy such as digital academic strategy literacy (DASL); (see 2.3.1) can be developed and taught. There is thus a need to conduct research that helps to understand and to improve international students’ L2 digital academic reading practices in a digital educational context. The following section introduces the aims of this research in detail.

## **1.4 Aims of the study**

The aim of this thesis is to gain an insight into a 21<sup>st</sup> century phenomena that requires more investigation, namely to investigate the nature of on-screen reading comprehension. It aims to propose a new element of academic reading which is called here ‘digital academic strategy literacy’ (DASL) (see 2.3.1 for further details), and to reflect the authentic on-screen academic reading comprehension experience of a group of international postgraduate Saudi students who are pursuing their studies through the medium of the English language in the UK educational context in a specific period of the technological revolution. This group of female non-native speakers of English

consisted of five Master's level students and fifteen PhD students who were studying at the University of Southampton.

The aim of the study was achieved through investigating several aspects of readers' on-screen reading comprehension. Most importantly, the study was designed to scrutinise readers' digital academic reading comprehension strategies (see 4.2) and the processes (see 4.5) that they employ to comprehend the text on-screen.

The challenges facing the group of postgraduate readers under investigation in becoming digitally strategy literate need to be investigated in order to determine the necessary solutions to any reading difficulties they encounter. Understanding the factors that demotivate readers to read on-screen would help researchers, educators and teachers to find suitable pedagogical solutions to enhance readers' on-screen academic reading comprehension and would highlight these challenges (see 7.3 for implications of the research findings). Thus, the present study aims to investigate the challenges that L2 academic readers experience during on-screen reading comprehension (see 4.7) and the strategies that they employ to overcome these challenges.

It also aims to look at the different strategies that readers use to approach different parts of the text, whether this is the text as a whole, or an individual section, paragraph, sentence, phrase or word and the linked sub-strategies and the patterns of interacting with text on-screen (see 4.3 & 4.4). Most importantly, this study aims to reveal the role of digital affordances during on-screen reading and readers' confidence in using these e-facilities during their on-screen reading comprehension (see 4.6) and the role of the proposed digital academic strategy literacy (DASL) in on-screen academic reading comprehension (see 7.2).

A further primary objective is to explore readers' preferences and perceptions regarding both on-screen and print-based reading (see 6.5.5). In this regard, the study identifies how L2 readers coming from a print-based educational background develop strategies for reading digital English academic materials (or fail to do so) throughout their studies in the UK. It also seeks to explore the factors that might have an effect on readers' reading preferences and practices. Following this investigation, a further objective is to consider whether there is a need to teach digital strategy literacy in the L1/L2 reading classroom and the sorts of materials and teaching methods that ought to be considered (see 7.3 for the research implications).

By achieving these aims, it is hoped that this study will shed some light on how readers actually read and comprehend academic text on-screen and will provide understanding and information for both L1 and L2 reading instructors, syllabus designers, teachers, educators and reading researchers about

the nature of on-screen academic reading, what readers do and do not during on-screen reading; and why and what they need. Thus, based on the findings of the study recommendations are made in this thesis (see 7.3) that aim to indirectly improve readers' on-screen reading comprehension and qualify them to cope with 21<sup>st</sup> century reading demands.

The study is framed by interpretivist philosophical orientation (see 3.2 for further details) and is guided by the following two main research questions:

1. What is the nature of the on-screen L2 academic cognitive reading strategies used by postgraduate students in the UK educational context when reading research articles in their field of study?
2. What are the similarities/dissimilarities between on-screen reading and print-based reading?

Based on these two main questions, sub-questions are presented in detail in 2.7

## **1.5 The thesis layout**

This work is organised into six chapters. Chapter one has presented an overview of the research study and has detailed the background and context, by discussing the status of reading comprehension in the digital era. It then has identified the rationale for the research, introduced the research aims, and outlined the main research questions, concluding with this summary of the structure of the thesis.

Chapter two provides an overview of L2 on-screen academic reading as a particular form of digital literacy. It examines practical traditional reading in detail with a particular emphasis on L2 academic reading. The chapter then focuses on investigating reading skills by discussing reading in general and on-screen reading in particular, providing a literature review and outlining the theoretical background to the study. It presents two schools of thought, cognitive and sociocultural theories and provides a detailed discussion of the two perspectives from which this study has been drawn. This is followed by a description of the constructivist theory and its relation to reading and a review of how readers construct their comprehension of text based on schema theory which comprises content and formal schemata. Finally, reading is presented from the social constructivist perspective and the role of the zone of proximal development (ZPD) in digital reading is then reviewed.

Chapter three outlines the methodology, beginning with discussing the qualitative research methods and the reasons for adopting a qualitative approach in the present study and a case study in

particular. It covers the sample for the study and the research materials. It considers the methods used to collect the data from the demographic questionnaire, think-aloud protocols, researcher's field notes, stimulated recalls and interviews; and the advantages and disadvantages of each. The chapter also discusses a number of relevant issues, such as the pilot research and the main study, including the tools used and the plan for implementation, triangulation, ethical issues and procedural tools for data analysis.

Chapter four starts with a synthesis of the major findings of the present study. It presents a number of proposed models illustrating on-screen academic reading interaction followed by detailed explanation of the complex matter of on-screen reading comprehension by presenting data and exemplifying each of the reading strategy categories, sub-strategies, the use of digital affordances and the reading challenges that face readers during on-screen academic reading comprehension.

Chapter five presents an overview of issues related to print-based academic reading comprehension. It presents the functional reading strategies; PROB, SUP, GLOB and CRT, and the sub-strategies that readers employed during the print-based academic reading task. The chapter also illustrates the challenges that readers experienced during their print-based reading comprehension. This is followed by comparing and contrasting the similarities and the differences between print-based reading and on-screen reading.

Chapter six provides a discussion of the findings. It examines the nature of on-screen L2 academic reading comprehension. It discusses the reading strategy categories employed by the readers and discusses them in terms of their consistency with previous research. This allows a conclusion to be drawn regarding the types of reading strategy categories and sub-strategies that postgraduate readers use most, and least often, and enables an interpretation of the uses that are made of them. This is followed by a discussion of how the strategies employed by the readers operate in terms of top-down and bottom-up processes and a description of the nature of this interaction. Then, the categorisation of the sub-strategies used to interact with various levels of text content is discussed. This is followed by a discussion of the digital affordances utilised by the participants in order to comprehend texts, illustrating the process of utilising these e-resources and the reasons behind their use.

After that, the challenges that face L2 academic readers when reading text displayed on-screen are examined. This leads to a discussion of the strategies that readers employ in order to overcome these challenges. Then, the chapter elaborates on the differences and similarities between reading on-screen and on printed paper. The chapter then explores the possible effects of reading in

different disciplinary areas by presenting three case studies. The effects of individual differences are discussed through two further case studies. The effects of previous reading practices and contextual factors are also discussed followed by the effect of length of study by comparing Master's students in Phase 1 (Ph1) and Phase 2 (Ph2) and by comparing Ph1 Master's students with PhD students. Finally, the chapter presents and discusses 21<sup>st</sup> century readers' reading preferences and perceptions regarding digital academic reading.

Chapter seven brings together the key areas of interest discussed in chapters four, five and six; and presents a summary and the main contributions of the current study to the reading research domain, including digital literacy and DASL. It then identifies potential implications for syllabus designers, researchers and teachers. After that, it discusses the challenges faced when conducting the present study and the limitations that were revealed. Finally, the chapter presents potential avenues for future research based on the findings of this study, followed by a summary of the present research findings and their contribution to the field.

## Chapter 2: **L2 academic reading as a particular form of digital literacy**

### **2.1 Introduction**

This chapter provides an overview of L2 on-screen academic reading as a particular form of digital literacy. It brings together the topics under the umbrella of digital literacy and discusses on-screen reading. This chapter is divided into four main sections, beginning with research on digital literacy (see 2.3), proposing digital academic strategy literacy (DASL) (see 2.3.1) with particular emphasis on the components of DASL in current research; information literacy and computer/ICT literacy (see 2.3.2 & 2.3.3). Knowledge of digital literacies is the gateway to understanding on-screen reading and the essential elements required by readers to interact with text on-screen, which is the focus of the present study. Thus, this chapter begins by addressing and discussing the concept of digital literacy to facilitate an understanding of the practical aspects of on-screen reading. Digital literacy is used in this study to define and scrutinise the academic competences and capabilities needed by individuals in order to achieve successful digital academic reading practice. Thus, digital academic strategy literacy (DASL) is proposed in this research and its components are discussed throughout the sections.

After presenting the range of topics under the umbrella of digital literacy, various elements are discussed in more detail, in particular digital reading and interacting with on-screen text. The second section of this chapter looks in depth at traditional print-based reading with a particular emphasis on L2 academic reading (see 2.4). The chapter then focuses on investigating reading comprehension by discussing reading in general and on-screen reading in particular (see 2.5), providing a literature review to outline the theoretical background to the study. The section compares the literature on digital reading with that on print-based reading and presents the differences and the similarities between the reading strategies used (see 2.5.1). The section highlights readers' different reading purposes and distinguishes between print-based reading and on-screen reading purposes (see 2.5.2 & 2.5.3). It also discusses the multiple genres that exist in the traditional formats and describes how some of these genres have been echoed in the digital area (see 2.5.4). The different cognitive reading strategies that are needed to interact with this different text genre are also presented. The chapter outlines the advantages and limitations of on-screen reading with regard to the digital affordances that readers may use to enhance their reading comprehension (see 2.5.5). The literature

review scrutinises the challenges experienced by readers that were identified in previous research studies. A comparison between the challenges of reading screen-based text and print based text are also made (see 2.5.6).

The fourth section presents two schools of thought; cognitive and sociocultural theories (see 2.6). It provides a further discussion of the two perspectives from which this study has been drawn. An overview of cognitive reading models, including reading as a bottom-up, top-down and interactive processes is presented using a chronological approach (see 2.6.1). It also explores the different cognitive views and what happens during the reading process. The researcher makes a distinction between two different processing levels: top-down and bottom-up. The bottom-up processes, such as word recognition and decoding, make it possible to convert written letters into words and meaningful sentences. In order to reach the main goal of reading, top-down reading processes are also needed as these enable readers to enhance their reading comprehension by drawing upon previous knowledge and making inferences from what is written in the text.

This is followed by a description of constructivist theory (see 2.6.2) and its relation to reading and a review of how readers construct their comprehension of text based on the schema theory which comprises content schemata and formal schemata (see 2.6.3). The cognitive nature of L2 reading as well as the influence of readers' schemata on L2 reading abilities and weaknesses are investigated. However, there are a range of views regarding what happens cognitively during the reading process. As a result, this section examines the different types of schemata that readers need to have in order to comprehend a text, namely content schemata and formal schemata. The last part of the section explores the role of readers and different schemata in reading comprehension, the role of linguistic variables and the role of background knowledge in the process of academic reading. It is argued in the present study that it is necessary to introduce digital schemata to the field of schema theory in reading. Reading is presented from the social constructivist perspective (see 2.6.4) and the role of the zone of proximal development (ZPD) in digital reading is then reviewed (see 2.6.5). Finally, the thesis main and sub-research questions are presented in 2.7.

## **2.2 A review and synthesis of relevant research**

The literature in this chapter reveals that there is not yet a solid base of research on digital reading strategies. There is a lack of studies which focus on on-screen reading practices and the reading strategies that postgraduate students employ and need in order to read and comprehend academic

text on-screen. Studies that have been carried out on this subject have employed limited research methods to investigate on-screen reading. In the studies reviewed, there is a lack of investigation into L2 digital academic reading from both cognitive and sociocultural perspectives, and no exploration of the changes that may occur to readers' digital academic reading practices as a result of socio-educational factors.

The literature views on-screen reading from a print-based reading perspective (see 2.4 for further details). Most of the studies reviewed have not examined digital academic reading in much detail. Much of the reading research up to now has applied the known reading strategies used by research students to read printed text to on-screen reading processes. Most reading researchers employed the questionnaire method to assess readers' on-screen reading strategies. The use of this method has limited the exploration and understanding of on-screen reading processes.

There have been quantitative analyses of on-screen reading strategies and some limited qualitative analyses (see 2.5.1). Research on the subject has been mostly restricted to limited comparisons of print-based reading strategies and on-screen reading strategies. Most of these research studies employed questionnaires based on known strategies in order to examine the difference between the two reading mediums. This kind of research limits the understanding of the actual differences and the similarities between the two reading formats and, as a result, such researchers have not been able to identify how on-screen reading is different from print-based reading. Also, there is a lack of depth of understanding of how reading on-screen can facilitate readers' reading comprehension. Little is known about the use of e-resources that L2 academic readers employ during on-screen text interaction.

Reading researchers are still debating the different aspects of screen-based reading such as its effectiveness and how it differs from print-based reading. There is a lack of understanding and different viewpoints regarding the effectiveness of on-screen reading for second language readers (see 2.5.5). The literature indicates that no clear strategies have been identified which can enhance readers' on-screen L2 academic reading practices and there are no clear guidelines that language teachers and educators can follow to enhance the teaching of on-screen reading skills. The literature lacks the depth and the breadth to explain the basic elements, procedures and aspects of on-screen reading. There is insufficient explanation of how reading occurs on-screen and how readers interact with digital academic text (see 2.5).

Taken together, this study argues that it is no longer enough to only educate students about traditional literacies and for them to be able to interact with traditional forms of information

presentation, as digital competences and capabilities are required to successfully achieve academic goals in the 21<sup>st</sup> century.

This chapter explores some of the key questions and highlights the need to focus on the previously discussed aspects of on-screen reading and to address the research gap through a qualitative examination of on-screen reading. The focus of this study is the on-screen L2 academic reading comprehension of a group of postgraduate (Master and PhD) female Saudi students within a UK educational context.

The following section presents digital literacy, and the proposed term 'digital academic strategy literacy (DASL)' with a particular emphasis on the components of DASL in the current research.

### **2.3 Digital literacy/literacies (DL)**

Due to the advent of various technologies and the vast amount of electronically available information, the meaning of literacy has changed from the competence and the ability to read, write and communicate socially to include new terms that have emerged in an attempt to expand upon traditional literacy and to reflect the current digital change (Lankshear & Knobel 2008). The elements that are needed for the 21<sup>st</sup> century and their functions are examined throughout this section.

The term digital literacy was first introduced by Gilster (1997), who defined it as 'the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers' (p.1). However, several authors referred to contemporary literacy practices and attempted to create alternative expressions for the term digital literacy. Bawden (2008) characterises it as the ability to read and comprehend information available in different media formats. Other researchers referred to it as information literacy (Iannuzzi 2000), electronic literacy (Warschauer 1999; Park & Kim 2011), computer literacy (Corbel & Gruba 2004), silicon literacy (Snyder 2002), techno-literacy (Lankshear et al. 2000) or multimedia literacy (Summey 2013). However, most researchers agreed to use the term digital literacy as it is the most appropriate phrase to represent contemporary literacy (Goodfellow 2011; Hockly et al. 2014; Sharpe & Beetham 2010; Beetham & Oliver 2010; Gilster 1997).

Several researchers argued that digital literacy refers to a set of cognitive skills that individuals need to acquire in the digital age. It is presented as users' abilities to interact with digital sources in an efficient manner. For example, Jones and Flannigan (2006) stated that digital literacy involves

several skills: reading, interpreting media and evaluating digital data to produce new knowledge. Jones and Flannigan (2006); and Martin and Dunsworth (2007) described digital literacy as the ability to perform tasks effectively in a digital environment, to read and comprehend information from a variety of media and to evaluate and apply knowledge gained from electronic media. Moran et al. (2008) stated that digital literacy describes the ability to interact with a wide range of digital information, such as images, video and audio clips, hypertext, hypermedia and webpages. Gilster (1997) defined digital literacy as the ability to effectively understand, handle and use information from a variety of digital sources via the medium of the Internet. The view of Eshet (2012) is in line with Gilster (1997), and maintained that it is not only the ability to use digital sources efficiently but also the ability to behave efficiently towards electronic information. Eshet (2012) concluded that digital literacy consists of four main core competencies; searching the Internet, navigating hypertext, assembling knowledge and evaluating content. Hockly et al. (2014) defined digital literacies as the 'individual and social skills needed to effectively interpret, manage, share and create meaning in the growing range of digital communication channels' (p.2).

Digital literacies is the umbrella term that encompasses multi-literacies that consist of several notions and sub-notions. In this regard, several researchers advocate that literacy must be pluralised to literacies (Lankshear & Knobel 2008; Jones & Hafner 2012; Hockly et al. 2014; Summey 2013). The JISC, the UK's higher, further education and skills sectors' organisation for digital services and solutions, (2014) defined digital literacies as individuals' capabilities that enable them to live, work and learn in a digital context during a specific era. The JISC's model of digital literacies capabilities involves eight notions (see Figure 1). The eighth element has only recently been added (JISC, 2014).

1. ICT proficiency based on the ability to use and interact with digital devices, software, application and sources, to critically assess the value and the benefits of ICT and to solve interactional problems.
2. Information and data literacy is the ability to deal and interact effectively and accurately with information that is presented electronically, such as searching, finding, evaluating, organising and interpreting. It also includes being aware of digital copyright and ethical and legal issues.
3. Media literacy is the ability to use a range of different media to critically read and produce information. It also involves the ability to consider media aspects, including purpose, accessibility, impact and audience.
4. Networking and digital participation is the ability to be effectively involved in digital networks and groups for learning, teaching, research and collaboration purposes.

5. Digital research and innovation is the ability to conduct research studies, analyse data, create new research questions or develop new ideas using digital methods and technology.
6. E-learning and professional development is the ability to use online facilities to teach, coach, train, support, give feedback, assess and learn.
7. Digital reputation and ID management is the ability to use a wide range of platforms effectively to create and manage digital reputations and identity.
8. Digital wellbeing is the ability to look after personal health, safety, relationships and to manage stress, workload and distraction in a digital setting. It also involves awareness of the impacts of digital technologies and activities on the surrounding environment.

The elements relevant to the current study are discussed in 2.3.1.

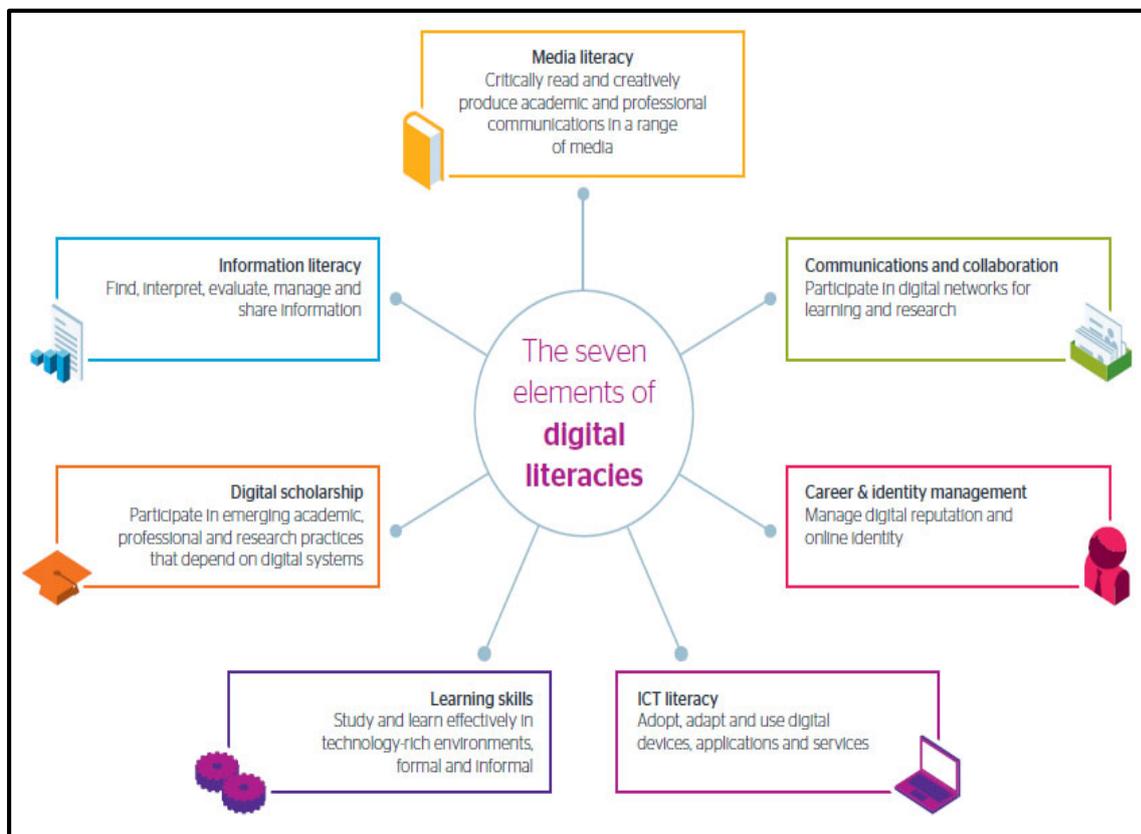


Figure 1: Seven elements of digital literacy: Developing students' digital literacy (Beetham and Sharpe's framework 2010, cited in JISC 2014, p.1) – the eighth element, digital wellbeing, has been added subsequently

Based on readers' roles and resources, Hinrichsen & Coombs (2014) proposed five dimensions for the role of readers in interaction with on-screen text and digital context, including:

1. Digital literacy
2. The critical literacy model developed by Luke and Freebody (1999)

Hinrichsen and Coombs (2014) termed the new proposed model critical digital literacy, which includes the following interrelated and overlapping notions (see Figure 2).

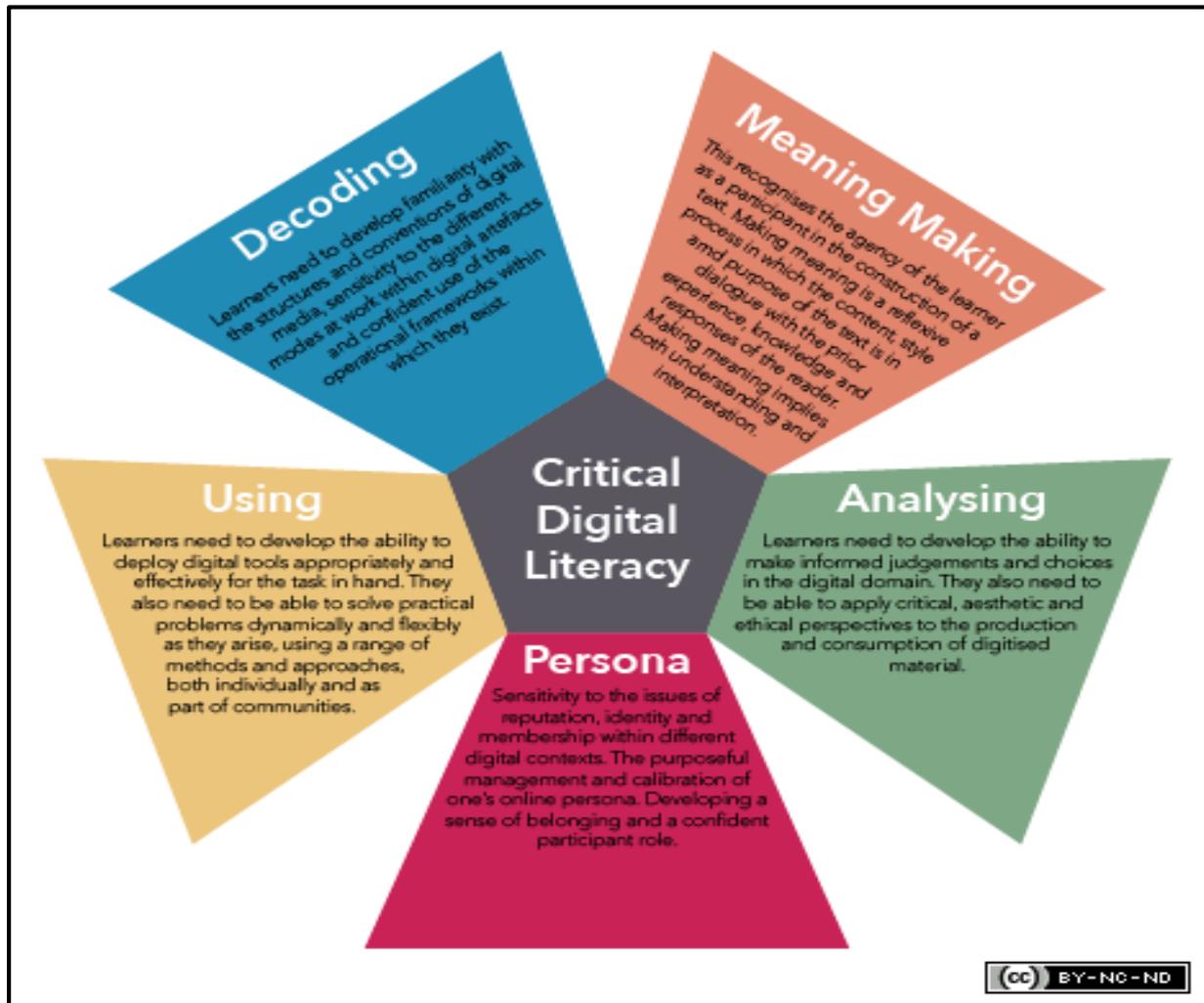


Figure 2: The five resources model of critical literacy (Hinrichsen & Coombs' framework 2014, cited in JISC 2014, p.22)

1. Decoding: the familiarity with digital media and the confidence to use it by understanding the navigational mechanisms, conventions and operations of digital media, such as ICT, online communication and computer functions. It also includes understanding the different stylistics of the text, such as presentational elements; and finally understanding the modalities that represent the different modes of digital texts, such as videos and SMS.

2. Making meaning: the ability to understand and interpret meanings by recognising digital text content, followed by integrating the content of the text, its style and purpose with previous knowledge and experience.
3. Using: the ability to find the most convenient and effective e-text resources and tools, apply them in accordance with ethical and legal criteria and to find and create solutions for digital interaction problems.
4. Analysing: the ability to deconstruct digital resources and digital interaction, select and make judgement on them and to interrogate their provenance, purpose and impact.
5. Persona: the ability to effectively build a digital identity and membership, manage a reputation and online activity and to participate, exchange and interact with communities, groups and/or individuals.

Drawing on the previously mentioned literature (Beetham and Sharpe's framework, cited in Jisc 2014; Jisc 2014; Hinrichsen & Coombs 2014), digital literacies in the current study is defined as a group of adaptable and transformative literacies that enable individuals to effectively engage, communicate and achieve academic objectives successfully and fluently. Digital literacies refer to the awareness, the capabilities to practice and to the attitude, behaviour, skills, confidence and fluency necessary to interact effectively with digital resources and to solve interacting problems. It includes decoding and encoding texts, accessing networks, collecting information, analysing, sorting, communicating and engaging. It can thus be argued that digital literacy requires individuals to employ a wide range of cognitive and social skills in order to perform effectively in digital environments. The above analysis of the previous literature also implies that digital literacy is not only one specific sort of literacy, instead; it involves multiple literacies on a broad spectrum that are associated with and complement each other. One of the literacies that is associated with on-screen reading and essential for 21st century students is the proposed digital academic strategy literacy (DASL).

### **2.3.1 Digital academic strategy literacy (DASL)**

Digital academic strategy literacy (DASL) is proposed in the present study and situated in the ICT literacy and information and data literacy areas of the JISC model (JISC 2014). It is also based on Gilster's (1997) perception of digital literacy, which is based on the two forms of literacies; 'information literacy' and 'computer literacy' (Lankshear & Knobel 2008). These two concepts describe the specific competences and capabilities that are essential for on-screen reading and

interacting with digital information. On the other hand, in the present study, other digital literacies have been excluded from DASL, such as digital wellbeing, career and identity management and digital scholarship

Digital academic strategy literacy (DASL) is proposed and defined in this study as the competences and capabilities to use a group of digital strategies (elements of different literacies) that enable readers to read text for academic purposes on-screen. It is about having the knowledge and capabilities to interact with text on-screen. This could be for a wide range of purposes, such as comprehension or for fact-finding. The following two sections situate DASL in digital literacies and illustrate the elements that form the components of digital academic strategy literacy (DASL); information literacy (IL) and computer/ICT literacy.

### **2.3.2 Information literacy (IL)**

It is argued here that one of the most essential elements that academic readers of the 21<sup>st</sup> century need is information literacy (IL). Moria and Ruth (2011) and Gui and Argentin (2011) argued that individuals possessing information literacy are able to effectively gather, use, manage, synthesise and create information and data in an ethical manner. Williams and Coles (2007) stated that information literacy consists of several elements, namely recognising and defining needed information, then locating, selecting and extracting information, followed by organising and synthesising information, and finally presenting and communicating information and evaluating the outcome. Information literacy is explained by the American Library Association Presidential Committee on Information Literacy as an individual's ability 'to recognize when information is needed' and 'the ability to locate, evaluate, and use effectively the needed information' (Fieldhouse & Nicholas 2008, p.52). Moria and Ruth (2011) (SCONUL Working Group) launched a new version of the seven pillars of information literacy. The new version of the seven pillars of information literacy represents the ability to:

1. Identify: 'identify a personal need for information'
2. Scope: 'assess current knowledge and identify gaps'
3. Plan: 'construct strategies for locating information and data'
4. Gather: 'locate and access the information and data they need'
5. Evaluate: 'review the research process and compare and evaluate information and data'
6. Manage: 'organise information professionally and ethically'
7. Present: 'apply the knowledge gained, present the results, synthesise information and create new knowledge' (Moria & Ruth 2011, p.5-11)

These elements partially formulate the proposed DASL that readers' need to interact with on-screen texts.

### **2.3.3 Computer/ICT literacy**

In addition to the previously mentioned elements of information literacy, the second element that is essential for 21<sup>st</sup> century readers is computer/ICT literacy as it partially constitutes the digital academic strategy literacy (DASL). Computer/ICT literacy involves the basic computing skills that are part of and a prerequisite for information literacy (Kurbanoglu 2003), such as connecting to the World Wide Web (Web), sending and receiving e-mails, participating in synchronous chat and using a search engine and database for problem-solving, organisation, communication and research (Johnson 2008; Martin & Dunsworth 2007). It also involves ICT (information and communication technology), which partly implies using technological tools, such as software applications, formatting a disc and saving, copying, deleting, opening and printing a file. Gupta (2006) stated that computer literacy involves the ability to operate a computer system which is the understanding of computer 'characteristics', 'capabilities' and 'applications'. It involves the individual's ability to actualise these aspects in a practical, skilful and productive manner. It includes a wide range of activities, such as texting, online chatting, browsing the World Wide Web, social networking, emailing, instant messaging (Lewis & Fabos 2005), visual presentations, using social networking sites, blogs and wikis (Wheeler & Wheeler 2009) and movie-making (Mills 2010). Deursen and Dijk (2010) stated that computer literacy also requires individuals to have Internet skills to be able to interact and use the online affordances.

With regard to the above, the critical digital literacy proposed by Hinrichsen and Coombs (2014) is considered in this study to describe the processes that learners need to experience in order to be digitally literate and to acquire ICT literacy and information and data literacy. Digital strategy literacy is acquired by the ability to decode digital information, obtain meaning from information and to analyse and use digital tools to form an online persona. The researcher's conception of digital academic strategy literacy in this study comprises having the (competences) the necessary awareness, and the (capabilities) the skills to achieve ICT and information/data literacy. It is argued in this study that the elements of digital literacies explained above are essential in order to enable learners to achieve digital strategy competences and capabilities and to be digitally strategy literate to be able to read on-screen effectively. This indicates a need to understand more about on-screen reading and the digital strategies required to interact with electronic texts.

## 2.4 Traditional reading

### 2.4.1 Reading

The term 'reading' differs greatly in its definitions, ranging from the simple to the complex and from the general to the more specific. However, there is no single definition which researchers in the field agree fully describes reading. Most reading researchers define reading as an individual cognitive procedure; for example, Eskey (2002) stated that reading is obtaining information from a written text. Others defined it as 'the process of receiving and interpreting information encoded in language form via the medium of print' (Urquhart & Weir 1998, p.22). Koda (2005) stated that reading is extracting information from the text and combining it with previous knowledge. Alderson et al. (2014) described reading as a process of interacting with the meaning of a text and creating further meanings during the process, thus giving rise to different meanings of a text based on the reader's reading purposes, background knowledge, culture, degree of attention, reading skills and criticality.

Other researchers defined reading as a strategic process during which a number of strategies are manipulated to comprehend text information (Grabe 2012). Shiotsu (2009) and Zoghi et al. (2010) defined reading as a cognitive activity that requires interaction between the text and knowledge that exists in the reader's mind. Romero and Romero (2008) summarised the most popular definitions of reading among reading educators thus: reading is the process of decoding written symbols, identifying and interpreting meaning from text, putting meaning into text, and communicating with the author of the text via the text itself. This indicates that early research viewed reading as an interaction that occurs between reader and text. In the last two decades researchers started to consider the contrasting view of reading as a social practice resulting from previous and current social interaction and experience (Au 1997, cited in Grabe 2012).

In the current electronic age, contemporary researchers have extended the definition of reading to include the ability to effectively interact with text presented in electronic format (Liu 2005; Gómez 2011). The many processes explained above provide a reasonable, functional definition of reading. They are not contradictory, but each focuses on a particular aspect of reading. Reading in this study is viewed as the act of interacting with a written text to achieve specific purposes. It is thus a complex cognitive social activity that occurs either in a printed and/or electronic text format, requires different sorts of schemata (competences) (see 2.6.3) and is achieved via different processes and strategies (capabilities) (see 2.6.1).

### **2.4.2 Academic reading**

Reading academic texts is an essential skill that undergraduate and postgraduate university students need to acquire and master to perform different academic tasks (Freeman & Freeman 2009). Several researchers stated that academic reading is different from general reading (Sengupta 2002; Tercanlioglu 2004). Academic reading involves different purposes for producing different academic tasks, by reading a large number of texts, publications and academic articles (Burns & Sinfield 2012). It requires good concentration and understanding as it introduces the reader to different ideas, perspectives and logics, by enabling them to think in a different manner, by being more objective and critical (Majid et al. 2010). Academic reading is more than just recognizing what is written on the page, it requires readers to employ an appropriate approach for the purposes of deciphering the deeper meaning of ideas presented in the content (Tercanlioglu 2004). Academic reading also requires the reader to gauge the concept, be critical and broaden the spectrum of existing knowledge of the subject, to become more well-informed, to find the concrete source of evidence, to be more interactive and to be an efficient reader (Hellekjær 2009). It is complex, purposeful, and involves multi-level skills consisting of identifying key ideas, understanding technical and unfamiliar words and linking new knowledge to individual schema or background knowledge in order to arrive at a suitable degree of understanding of a text (Sterzik & Fraser 2012; Grabe 2012). These findings illustrate that top-down reading techniques are the main aspects of academic reading (see 2.6.1 for further details about cognitive reading approaches).

### **2.4.3 Critical thinking**

Academic reading involves the development of critical thinking skills, which are essential for college students to be successful (Wallace & Wray 2011). Critical reading has been defined as the ability to clarify purpose, make use of relevant background knowledge, focus on major content, critically evaluate content, draw and test inferences, monitor comprehension, discriminate between work of higher and lower quality, make informed judgments about content and provide reasoned explanations for the judgments (Wallace & Wray 2011). It also involves strategies, such as close and detailed reading of a text, reflective thinking, and metacognitive strategies that enable the reader to interact with the text, make enquiries, ask questions and form predictions and assumptions (Wyatt 2003). According to Gaetjens (1997) critical reading is readers' ability to identify the main theme of a text, understand its tone and analyse its content. Some of these aspects are directly related to the top-down reading approach that is presented in global reading strategies, such as using prior

knowledge and having a purpose during reading (see 2.6.1 for further details). However, these techniques are not sufficient to read critically in an academic context. Student readers need other techniques to read critically. It involves knowing the period in which the material was written, the place of publishing, its reputation and the qualification of the author (Hancock 2006; McWhorter 2010). It also includes interpreting the author's message, purpose and asking critical questions such as 'is the author biased', 'does the author make assumptions', and 'how does the author support the ideas' (Ibid.).

These characteristics imply that academic reading can be a demanding task for native speaking students and even more challenging for L2 students who had most of their previous education in a different culture, society and educational system; and in their native languages. In addition, most previous studies in the EAP context focused on writing skills, while there was little research that focused on academic reading, particularly for non-native speakers. Therefore, investigating L2 academic reading and attempting to assist L2 readers to read efficiently in an academic context is an important area of research in the field of academic reading.

#### **2.4.4 L1 and L2 reading**

Both L1 and L2 reading processes have been studied by a number of researchers (Bernhardt & Kamil 1995; Maeng 2005; Park 2013; Shiotsu 2009; Yoshida 2012; Talebi 2015; Karimi 2015; Yamashita & Shiotsu 2015). However, the research on L1 reading processes is more extensive and complex than that on L2 reading processes. Existing models of the reading process have been constructed according to L1 general reading research. Reading research has examined all aspects and fields of the reading process, such as reading strategies, reading components and reading processes. However, literature on the L2 academic reading context draws from extensive research already conducted on L1 general reading processes. According to Grabe and Stoller (2011) and Koda (2012), L2 academic reading research uses the theoretical insights gained from L1 ordinary reading research.

There is much debate among reading researchers regarding situating second language reading in relation to first language reading in terms of learning to read. Reading in a second language is defined as reading in a language other than the mother tongue, either for education, job enhancement or interest. Several researchers argued for the independence of first and second language reading. Bernhardt (1998) claimed that L2 reading is a phenomenon that has different characteristics to L1 reading. Koda (1996, 2005) declared that the difference that occurs between L1 and L2 reading is due to the cross linguistic feature of the L2 reading process. That is, L2 reading consists of more than one language. Hudson (2007) stated that learning to read in a second language

differs from learning to read in a first language, as readers are already literate in their first language. Koda (2005, 1996) also stated that L1 differs from L2 reading as L2 readers learn to read in a second language in different social and institutional contexts and for different purposes.

In contrast, other reading researchers advocate the similarities and correlation between first and second language reading. Alderson et al. (2014) asserted that reading in L2 is an ability that is transferred from reading in L1. Singhal (1998) stated that reading in both L1 and L2 is a meaning making process that requires readers to use corresponding mental activities and specific behaviours in order to interact with the text, facilitate comprehension and construct meaning. Several reading researchers found that the cognitive strategies and meta-cognitive strategies developed in L1 reading can facilitate L2 reading. Gelderen et al. (2007) claimed that good L1 readers are also good L2 readers. Alderson (1984) stated that the ability to read in L2 depends upon the reader's L1 reading ability. He declared that poor reading ability in L1 leads to poor reading ability in L2. Bernhardt (2011) highlighted the importance of L1 literacy skills in fostering L2 reading comprehension.

Concerning these two perspectives of the relationship between first and second language reading, two hypotheses have emerged, namely the Language Interdependence Hypothesis (LIH) and the Language Threshold Hypothesis (LTH) (Hedgcock & Ferris 2009). The Language Interdependence Hypothesis assumes that L1 and L2 language skills are independent and there is a fundamental similarity between their processes (Cummins 1991). In reading skills, an automatic transfer occurs in cognitive reading ability and reading experience between L1 and L2. That is, readers do not need to learn reading in L2 if they have a certain level of L1 reading ability. They possess a range of various skills from their L1 reading which can be transferred to their L2 reading. A number of studies proved the role of the (LTH) in L2 reading (Gelderen et al. 2007; Droop & Verhoeven 2003; Gelderen et al. 2004; Sparks et al. 2012). Although the previous literature supports Cummins' hypothesis of (LIH), Cummins (1979) himself identified the limitation of this hypothesis and advocated the role of L2 language knowledge (LTH) in L2 reading.

The Language Threshold Hypothesis (LTH) presents academic skills such as L2 reading from the perspective of L2 language development (August 2006). It emphasizes the role of L2 language proficiency in L2 reading (Alderson et al. 2014; Cummins 1979). The (LTH) argues that a sufficient amount of L2 language knowledge is necessary to use the skills and strategies employed in L1 reading (Grabe & Stoller 2011). That is, L2 readers need linguistic knowledge before being able to transfer their L1 reading abilities and read in L2. In this regard, a number of studies advocate the

importance of L2 linguistic knowledge in L2 reading comprehension (Gottardo & Mueller 2009; Guo & Roehring 2011; Li et al. 2012; Schmitt et al. 2011).

This literature reveals that the argument between the two hypotheses is not about the existence of the transfer process between L1 and L2 reading skills but about when the transfer happens. That is, the previous literature supports both Cummins's (1979) hypotheses, and emphasizes that L1 reading knowledge transfer can only occur after learners have gained a sufficient level of L2 knowledge.

The author of the current study argues that L2 reading comprehension is similar to L1 reading comprehension and the differences occur only in dealing with the linguistic system of each language, such as vocabulary, grammatical and rhetorical aspects. This means that second language reading consists of first language reading processes and second language proficiency. According to Bernhardt and Kamil (1995), L2 reading involves both language proficiency (LTH) and L1 reading ability (LIH). Hudson (2007) also argued that first language reading ability is an essential element of second language reading. He also advocated the importance of readers' second language proficiency as an essential component for second language reading. A number of studies provided evidence for the role of L2 language proficiency and L1 reading abilities in assisting L2 reading comprehension (see Brisbois 1995; Asfaha et al. 2009; Yamashita 2002; Gelderen et al. 2007b; Carrell 1991).

The literature examined up to this point has considered only two variables that have an effect on second language reading. These are L1 reading knowledge and L2 language proficiency. However, there are further factors that may influence L2 reading performance. Grabe (2012); and Grabe and Stoller (2011), classified two other major sets of variables. First, the individual and experiential differences contained in readers' L1 and L2 reading. These are presented in five variables: (1) differing levels of readers' L1 reading abilities; (2) L2 reading motivations; (3) amount of exposure to L2 reading; (4) kinds of texts used in L2 context; and (5) language resources for L2 readers (i.e. the use of bilingual dictionaries, text translations, and learner based grammar textbooks).

Second, the sociocultural and institutional factors advocated in L1 and L2 reading are presented in the following: the differing sociocultural backgrounds of L2 readers; differing expectations of L1 and L2 educational institutions when it comes to reading texts; and differing ways of organising discourse and text (Ibid.).

The researcher therefore views L2 academic reading as comprising of five elements:

1. L1 reading practices
2. L2 language proficiency
3. (Content schemata) Subject area

4. Individual differences
5. (Perhaps most importantly) contextual factors

The researcher in the present study argues that being a successful reader should include the element of understanding the demands of the reading context, for example, being a successful reader in a specific context does not necessarily lead to being a successful reader in another. Therefore, an investigation of L2 reading is not (as stated in previous literature) solely a matter of L1 reading ability or L2 language proficiency, but also depends on the demands of the context and readers' reading practices in a specific era. In this regard, the phenomenon of digital literacy, in particular on-screen reading is considered.

## **2.5 Reading from old to new: On-screen reading**

Contemporary academic digital information has influenced L1 and L2 university students' reading practices in terms of reading academic texts in a specific field of study in an electronic or digital mode. E-texts are viewed via a screen using two different formats. Hypertext involves several links and provides nonlinear information via several forms, such as webpages, graphics, sound, video and animation (Nielsen 1990; Ketabi et al. 2012). It links textual materials, ideas and sources (Chen 2010; Salmerón et al. 2010; Park & Kim 2011). The other format of on-screen text is static, prepared and stored in advance, such as PDF and JPG files. It also involves reading with multiple modalities and additional sources, such as graphics, animations, video, audio and hyperlinks (Hartman 2011).

Reading on-screen in this study is defined as the act of interacting with an e-text presented through electronic screens using digital strategies and e-resources to achieve specific purposes. It requires competences (schemata), particularly digital schema and capabilities, to enhance digital reading comprehension and to solve digital reading challenges.

### **2.5.1 Strategies for on-screen academic reading**

The focus of this research is on the cognitive reading comprehension strategies that enable readers to comprehend a text. Cognitive reading strategies are defined as learning techniques, behaviours and problem-solving that make reading more effective and efficient (Oxford & Crookall 1989; Anderson 1999). According to Wallace (2001) reading strategies are the readers' conscious actions employed to comprehend a written text. They are the ways that readers use to manage their interaction with written text (Ibid.). Graesser (2012) asserted that cognitive reading strategies are

employed by readers in order to improve some aspects of reading comprehension and/or handle reading obstacles. Reading strategies indicate how readers conceive of a task, how they make sense of what they read and what they do when they do not understand (Koda 2005). In short, such strategies are processes used by the reader to enhance reading comprehension and overcome comprehension challenges and failures.

Current research into second and foreign language reading has begun to focus on the reading strategies used by L2 readers to process L2 written text. Researchers suggest that L2 readers use a variety of reading strategies to assist them with the comprehension, acquisition, storage and retrieval of information from a written text Hudson (2007). These strategies comprise scanning for specific details, using background knowledge, recognizing main ideas, re-reading, selective reading, adjusting speed, self-generating questions, summarising, predicting and guessing unknown words from context.

Reading researchers categorized reading strategies into three groups; linguistic, paralinguistic and semantic. These strategies can be employed by L2 readers to comprehend reading text effectively (Wright & Brown 2006). First, linguistic strategies involve a process of associating the written elements with its corresponding sounds by means of reading aloud (Wright & Brown 2006). Linguistic strategies also involve analysing new items by using similar known items, identifying grammatical categories and understanding sentence structure (Ibid.). Second, paralinguistic strategies 'aim at making texts accessible from the outset' and allow L2 readers to gain confidence and increase motivation (Wright & Brown 2006, p.23). Readers utilize paralinguistic strategies to improve their reading comprehension by recognizing text genre, predicting the type of language used by the author, and using punctuation as cues to interpret meanings (Wright & Brown 2006). Third, L2 readers can comprehend reading text via semantic strategies that involve two types of reading; skimming and scanning (Ibid.).

Other researchers classified reading strategies according to a three-phase approach: before, during, and after reading strategies. The before reading stage includes strategies such as engaging readers' background (Frager 1993; Varaprasad 1996), previewing and anticipating the content of the text, comments on visuals and acknowledging new words (Saricoban 2002). The during-reading stage consists of strategies, such as understanding the writer's purpose and intention, understanding the text structure and the logical organization of the text, using inferencing and judging, skimming (surveying the general information), scanning (looking for specific information) and finding answers to specific questions (Varaprasad 1996). The post-reading stage includes strategies, such as making

connections, reviewing the first two stages, deep analysis and critiquing the text and summarizing the reading passage (Saricoban 2002).

The discussion now turns from paper-reading strategies to on-screen reading strategies. Recently, reading researchers have attempted to differentiate between the required reading strategies for paper and for digital reading. The literature raises questions about the differences between paper and digital reading strategies. In this regard, Park and Kim (2011) conducted a study to investigate the reading-strategies of three adult English language learners when they read digital texts in hypermedia learning environments. The researchers found that most of the participants employed common paper reading strategies to read digitally. They also found that the participants used two new reading strategies for digital reading, namely hypermedia and computer accessories such as using a mouse pointer as a substitute for pen and pencil, using menu and navigation options and using multimedia resources.

Several studies have investigated and identified specific digital reading strategies used by readers when they read digital text. For example, Anderson (2003) conducted a study to examine the role of second language reading strategies within the context of digital reading tasks for 247 EFL and ESL readers. He adapted the Survey of Reading Strategies (SORS) that comprises 38 items relating to three reading strategy categories; problem-solving reading strategies, support reading strategies and global reading strategies. He named it the Online Survey of Reading Strategies (OSORS). Another research study was conducted in the same field by Yutdhana (2007) on 205 Thai graduate students from three faculties; Social Sciences, Health Sciences and Sciences and Technology. The study used the OSORS survey to explore the digital reading strategies used by second language graduate students and to examine whether students from three faculties employed different digital reading strategies. The findings revealed that graduate students most frequently used the global reading strategies and the problem-solving strategies, while the support reading strategies were used the least.

The previous studies demonstrate that digital reading requires readers to employ the traditional paper reading strategies as well as different types of reading strategies such as using hyperlinks, navigational strategies, and computer accessories. However, these studies did not compare the paper and digital reading strategies employed by the same readers to assess precisely the differences between reading strategies for text in paper and digital form. In this regard, very few studies have been conducted, for example, Zaki et al. (2009) investigated the digital and printed reading strategies used by 109 ESL undergraduates at a university in Malaysia. The findings of the

two surveys; SORS and OSORS revealed that three reading strategies; global, support and problem-solving, were employed when reading digital and printed formats. However, it found that digital readers employ significantly more strategies compared to print-based readers. That is, more global and problem-solving strategies are employed when reading digitally compared to printed-paper. In contrast to the above results, support strategies for printed reading have significantly higher mean values compared to digital reading. However, relying only on the survey to compare paper and digital reading strategies is not sufficient to assess the differences between the two. Therefore, there is a need to scrutinize the differences between the actual reading strategies used for paper-based and digital reading by the same readers via other means, such as think-aloud protocols and stimulated recalls. By doing this, a complete picture of the components of digital reading strategies will be seen.

From the previous discussion, it can be seen that the reading strategies required for reading from paper sources are similar to the reading strategies required for reading from digital sources. However, SORS and OSORS are very limited reading measures, and most reading researchers who adopted them in studies of digital reading did not extend them using stimulated and interview protocols to investigate whether new strategies are being utilized by readers, such as social reading. In addition, studies which adopted the OSORS did not use instruments to explore and investigate readers' actual reading strategies and/or use of electronic aids as new strategies to enhance their reading comprehension. In this regard, Huang et al. (2009) adopted the OSORS reading strategies to investigate EFL learners' digital reading strategies and the effects of strategy use on comprehension. The researchers added a fourth category to the OSORS to compensate for the missing socio-affective strategies that consist of using online chat rooms, discussion boards, email services and music boxes. However, the scheme that they used to explore readers' digital reading strategies remained limited as it measured fixed strategies and did not include observation or interviews to identify uses of electronic aids which support reading comprehension. Moreover, although some of these studies adopted the SORS and OSORS to explore the academic reading strategies of university students, they neglected to include an essential aspect of academic reading, namely critical reading strategies. Instead, they only examined the general technique of analysing and evaluating information, which does not involve the application of critical thinking. Furthermore, all the previous reading studies have examined readers during only one period of time; therefore, the changes in readers' use of print and digital reading strategies over time have not been investigated. More significantly, the influence of readers' social interaction on the print and digital reading strategies employed (the cognitive strategies) has only been examined in a few studies.

In a similar vein, there are a few studies (Akyel & Erçetin 2009; Ketabi et al. 2012; Park & Kim 2011) which have investigated readers' hypermedia reading strategies and explored new strategies for digital reading. Akyel and Erçetin (2009) investigated the reading strategies of ten undergraduate English learners enrolled in an ELT Department at a Turkish university while reading a hypermedia document. The researchers found that readers employed new types of reading strategies, such as navigational strategies and use of annotations when reading the hypermedia document. Ketabi et al. (2012) investigated the reading strategies of twenty-three Persian EFL graduate students while reading a hypermedia text format. It found that readers employed several sorts of strategies, such as referring to annotations, referring to the glossary, paraphrasing in L1/L2, re-reading, using background knowledge, skipping/skimming, formulating questions, and making predictions. However, there is a dearth of research investigating digital reading strategies when it comes to digital static texts. Following a presentation and discussion of previous research studies concerning on-screen reading strategies, the present research adopts three main reading strategy categories, outlined by the OSORS survey (Anderson 2003), to investigate readers' on-screen reading strategies.

1. Problem-solving reading strategies (PROB)
2. Support reading strategies (SUP)
3. Global reading strategies (GLOB)

(see 3.9.2 for further details regarding these functional strategies)

The following section presents another factor, reading for different academic purposes, that also structures and manipulates readers' reading strategies.

### **2.5.2 Different academic purposes and on-screen reading**

In the case of print-based reading, studies have differentiated between two main purposes of reading: reading for entertainment and reading for study purposes. Researchers have distinguished between the strategies that are employed by readers in the two cases. Generally, people read newspapers, magazines, recipes, TV guides, etc. for entertainment. Students, in contrast, read other genres, such as text books, research articles, and reports with the intention of being able to perform academic tasks such as taking a test, learning, gaining and integrating specific information, writing a paper or an assignment, discussing in class, evaluating, critiquing, or giving a presentation (Grabe & Stoller 2011; Plakans 2009; Grabe 2012). Reading research has shown that different reading purposes require readers to process texts differently (Linderholm et al. 2008; Plakans 2009; Koda

2005; Broek et al. 2001). For example, a study conducted by Linderholm et al. (2008) examined the reading times and the monitoring capacity of college student readers. In their study, readers read an expository text under one of two reading purpose conditions - reading for study and reading for entertainment - and then answered comprehension questions about the text. The results of the study indicated that the low working memory capacity of readers' reading times were slower when reading for entertainment purposes than when reading for study purposes. Researchers concluded that reading purpose affects cognitive and metacognitive reading processing and recall patterns (Linderholm et al. 2008).

When it comes to on-screen reading, which is the main concern of this study, researchers have also investigated how readers read for different purposes on the Internet. They made a distinction between different Internet reading purposes, for example, reading to locate specific information; reading to acquire general knowledge about a topic, and reading for entertainment (Zhang & Duke 2008). These different purposes of reading on the Internet may lead to the use of different reading strategies. In this regard, Slatin (1994) categorises two types of Internet readers: the user and the browser. The user is the one who 'enters the hyper document in search of specific information and leaves it again after locating that information'. The browser is the one who 'wanders rather aimlessly (but not carelessly) through an area, picking things up and putting them down as curiosity or momentary interest dictates' (p. 159). Zhang and Duke (2008) explored the variance that occurs in L1 adult good readers' reading strategies when they read on-screen text for three different reading purposes, namely to search for specific information, to acquire general knowledge, and for entertainment. The researchers found that the readers adopted different reading strategies for the different Internet reading purposes. That is, readers went through three distinct phases when reading in order to locate specific information and two phases when they read in order to acquire general knowledge. Readers used strategies to evaluate information and make decisions only when they read to locate specific information. Regarding reading for enjoyment, researchers found that readers skipped the initial search phase used by readers for the other two reading purposes, because they already had a favourite website in mind before starting to read. Another strategic difference between reading for these three purposes is the reader's strategy to choose, enter and re-enter the search query words (Ibid.). The researchers also reported that readers intentionally avoid advertisements when reading for locating specific information and acquiring general knowledge, while they follow advertising links when reading for entertainment. Moreover, readers read graphics differently for each reading purpose. When they want to locate specific information, they pay little attention to graphics, when they read in order to acquire general knowledge or for the

purpose of entertainment, they pay more attention to photos, cartoons, charts and graphs (Zhang and Duke 2008).

However, a review of the literature indicates that few studies have been carried out on the purposes of postgraduates' academic reading such as comprehension in order to learn or write; their on-screen reading purposes and the reading strategies that they employ particularly within the UK educational context. More research is required to distinguish the aims of academic reading in relation to the different reading formats (on-screen and printed text) and the associated reading strategies used by second language postgraduate students. It is also clear that there is a difference between finding and selecting the appropriate text and reading the text itself. The researcher's focus in the current study is not on how readers find the text, but it is on how they read and comprehend the text once they find it, although the internet allows the reader to browse and navigate during reading.

### **2.5.3 Reading for comprehension**

When it comes to academic reading purposes, reading for comprehension is the most basic purpose for reading and the common underlying process that is activated during reading. According to Chen et al. (2011), all reading purposes should be preceded by the comprehension of the written content. For example, readers who are reading to search for specific information, to learn, to integrate information, to produce a written or oral outcome or to evaluate should comprehend the written material in advance to be able to proceed to the next purpose.

Graesser (2012) summarised the general components of the comprehension process included in several definitions as: 1) the interpretation of the text; 2) the use of prior knowledge; and 3) the construction of a coherent representation of the content of the text. It is acknowledged that reading comprehension requires many supporting skills. It demands the 'ability to mentally interconnect different events in the text and form a coherent representation of what the text is about' (Kendeou et al. 2007, p.28). It also includes processing of vocabulary knowledge, background knowledge and knowledge of grammar, metacognitive awareness and cognitive reading strategies (Koda 2005; Qian 2002; Gelderen et al. 2004). Grabe and Stoller (2011) stated that reading for comprehension is a complex process affected by numerous factors, such as language abilities, goals and motivations.

Gunderson (2008) distinguished between three types of reading comprehension; literal comprehension, inferential comprehension and critical or evaluative comprehension. Literal

comprehension, which means understanding based on syntactic and semantic knowledge, is the process of understanding texts based on the surface level of the written content. Inferential comprehension requires the reader to understand the content of the text in depth rather than at surface level. Readers should understand the writer's idea and purpose, form generalizations about the text, and predict outcomes. Evaluative comprehension refers to the reader's judgment of the text in regard to validity, factual information versus opinion and the ability to transfer the acquired knowledge to other situations.

Comprehension in this study refers to the reader's ability to derive meaning from text by understanding the surface level of ideas and continuing to understand the deeper meanings including comprehending information and language. It also involves connecting the ideas that are presented and conveyed in a text by using different sorts of schemata; digital, formal and content (competences) and employing reading approaches including reading comprehension strategies and digital affordances (capabilities).

The discussion above highlights the fact that more research studies are needed to understand the reading comprehension strategies that are employed for different academic study purposes by second language postgraduate students. This study aims to address that gap by focussing on the reading comprehension strategies that postgraduate students employ when reading on-screen academic research articles in their field of study in order to comprehend the material and learn using the digital affordances mentioned in 2.5.5. The following section highlights the role that genre and discipline play in reading comprehension strategies.

#### **2.5.4 Genre, discipline and on-screen reading**

This section discusses the use of the term 'genre' in this work, relative to its effect on reading strategies. Genre is a 'rhetorical strategy used within a professional culture to organize knowledge in the form of professional action to achieve the objectives of professional communities' (Bhatia 2004, p.179). It represents a standardized form of language that is particular to specific institutions and communities, such as a formal letter, oral presentations, interviews and reports (Grabe 2012; Roldán-Riejos & Úbeda-Mansilla 2006; Hudson 2007). With reference to the written genre, Grabe (2012) stated that genre is 'specific patterns and systems of text organization that reflect the goals of the writer, the purpose of writing specific texts, and the expectations of skilled readers' (p.248). The written genre is 'a social practice through which writers interact with readers' (Soliday 2011, p.2). The written genre can include many different types of texts that are available to readers and each type has its own distinctive characteristics, such as a letter, sign, newspaper or message.

Hudson (2007) classified written text into two main types; description fiction, such as novels and plays; and nonfiction, such as essays, reports, articles, textbooks and conference papers.

In this vein, researchers attempted to differentiate between genre and sub or part genre. For example, New York Times articles and Weekly World news articles are a sub-genre of the newspaper article genre; and survey articles, and review articles are considered to be sub-genres of the research article genre, (Hudson 2007). Also, within the academic research articles genre, researchers categorized other sub-genres; abstract, introduction, methodology, results and discussion. Each part has its own defined purpose and organization (Samraj 2005).

The digital text genre domain comprises a considerable number of genres that already exist in the printed world. These genres, such as e-books, e-newspaper, e-magazines and e-reports, have been modified to suit the digital medium. However, there are new digital genres that have no obvious paper equivalent, such as the homepage (Askehave & Ellerup Nielsen 2005; Dillon & Gushrowski 2000), blogs (Miller & Shepherd 2009) and Wikipedia (Tereszkiewicz 2010).

Digital genres have been grouped into five different kinds: reproduced, adapted, emergent, spontaneous and emerging genres (Tereszkiewicz 2010). Reproduced web genres are replicated genres, which have been completely transferred from the traditional media to the web, such as dictionaries, official forms, scholarly papers and scientific journals. Adapted genres are similar to the reproduced ones in terms of their transferability but they exhibit a degree of difference in their pragmatic and structural features when compared to their counterparts in the traditional media, such as e-books and e-zines. Emergent genres include a considerable number of the generic aspects of their traditional counterparts but are characterised by significant developed functional attributes that make them dependent on e-media. In addition, their conventions and rules of usage have been acknowledged by their authors and users such as blogs, chats and e-mails. Spontaneous genres have no counterpart in traditional media and are entirely dependent upon new media. They are formed by the rules that govern the functions of the web such as homepages, error pages, portals and search engines. Emerging genres are genres that are still in the process of development and lack conventions, which need to be acknowledged by a community of users.

Although there is a growing body of research on print-based reading comprehension and related written genres, few studies have investigated the reading processes and strategies used in relation to digital genres. Researchers such as the RAND group (Snow 2002) demonstrated that text distinct features and text genre influence the reading comprehension process and require readers to react

differently to the written text. In this regard, researchers investigated the reading strategies that readers employ when they read narrative and expository texts (Grabe 2012; Yoshida 2012; Primor et al. 2011). For instance, Park (2010) scrutinized the differences between the reading strategies of one hundred and fifteen Korean college students when they read authentic expository/technical texts versus when they read authentic narrative texts. The researcher used the Survey of Reading Strategy (SORS) to measure the students' reading strategy use (Park 2010). The survey revealed that the Korean EFL college students used reading strategies with high frequency when they read authentic expository/technical texts in English and with lower frequency when reading authentic narrative texts. More specifically, Korean students used Global and Support strategies more when they read authentic expository/technical texts than when they read authentic narrative texts (Ibid.). This study demonstrates that there are indeed differences in the reading process depending on the type of text.

In addition, reading research has focused on the effect of different written texts in different disciplines on readers' reading strategies. Reading researchers are concerned with discipline differences within genre and the relationship between the variations within disciplines and the ways in which genres are formulated. For example, Hewings (2006) stated that 'variations in the characteristic patterns of academic writing occur not only from genre to genre but within genres from discipline to discipline' (p.14). According to Hyland (2009), disciplines affect the use of language to engage with others in a recognised and familiar way. They structure the written work and provide specific conventions and particular expectations that make texts meaningful for specific groups. In this vein, Parodi (2008) defined disciplinary text as a discourse genre with the 'macropurpose [...] to present, to a specialized audience, one or more topics on a particular subject matter belonging to a field of study' (p.492).

Hyland (2009) summarised the effect of different disciplines; Sciences, Social Sciences and Humanities on the written genre. Science writing, such as Biology, Engineering and Physics highlight a gap in knowledge, present a hypothesis related to this gap, and report experimental findings to support this in a standard format consisting of Introduction, Methods, Results and Discussion. The Humanities disciplines, such as Literature, History and Philosophy usually rely on a specific approach, such as case studies and narratives. They present and prove their claims via arguments. The Social Sciences, such as Sociology and Economics adopt the methods of the Sciences, but apply them to human data to give an explicit interpretation. Hyland (2009) also distinguished between the different ways that the three different disciplines ask research questions, address literature, criticize

ideas and present arguments by comparing the use of citations, reporting verbs, hedges, self-mention, directives and bundles.

The differences that exist between disciplines led reading researchers to investigate the reading strategies that readers use to read and comprehend texts in different disciplines. For example, Jafari and Shokrpour (2012) investigated the reading strategies of eighty one male and female Iranian ESP students studying at the Shiraz University of Medical Sciences from different disciplines (Environmental Health, and Occupational Health and Safety, and Midwifery) when they read authentic expository texts in English. They used the Survey of Reading Strategies (SORS) of Sheorey and Mokhtari (2001). The survey revealed that the two different disciplines used different reading strategies. That is, students majoring in Environmental Health used more reading strategies, such as using reference materials, going back and forth in the text and translating than those majoring in Occupational Health and Safety and Midwifery. Park also (2010) used the Survey of SORS to investigate the reading strategies of Korean students from different disciplines; Education, Social Sciences, Engineering, Humanities, and Business. He found significant differences in the overall use of reading strategies across the four academic major groups. The Education, Social sciences and Humanities majors used all three strategy categories more frequently than the Engineering students. Educations, Social Sciences and Humanities majors' students reported using the reading strategies more frequently than the Business majors' students who reported using them more frequently than the Engineering students. These studies argue that reading in different disciplines requires different reading strategies. However, none of the previous research studies have used relevant techniques to scrutinize the actual and applicable reading strategies that are employed by readers reading in different disciplines rather than relying on readers' self-reports.

In the academic genre, discipline domain researchers have examined the rhetorical features of the sub-genre of research articles; Abstract, Introduction, Methodology, Results, Discussion, and Conclusion in different disciplines. However, there are no studies that investigate the process of reading that occurs during each part of the research article in a range of disciplines. For example, Ruiying and Allison (2004) conducted a study to describe and understand the macro-structural organization of research articles in the discipline of Applied Linguistics. Martin (2003) investigated the rhetorical variation in experimental Social Sciences, research article 'Abstracts' written in English and Spanish. Ozturk (2007) explored the degree of variability in the structure of research article 'Introductions' in two sub-disciplines of Applied Linguistics. Lim (2010) compared the 'Results' sections of research articles in Applied Linguistics and Education. Samraj (2005) compared the

generic structure of research article 'Introductions' and 'Abstracts' in two related fields, Conservation Biology and Wildlife Behaviour. He found that research article 'Introductions' and 'Abstracts' in Conservation Biology were similar in function and organization to the same two genres in Wildlife Behaviour. He also found that 'Abstracts' from both were similar in rhetorical structure as they contained purpose, results and conclusions. Basturkmen (2012) examined the 'Discussion' sections of articles in Dentistry with reference to the 'Discussion' sections in Applied Linguistics. He found that the structure of 'Discussion' sections in Dentistry included similar moves and similar rhetorical purposes to Applied Linguistics, namely reviewing the study, summarising results, reporting a specific result or related results and commenting on them. Although, numerous studies have examined the differences and similarities between the research article genre and its sub-genres within a range of disciplines, very few studies have investigated and compared the reading strategies used when reading on-screen research articles and their sub-genres in different disciplines. In addition, few research studies have scrutinised the effects of interacting with the different sub-genres of a research article on readers' use of reading strategies during on-screen reading.

#### **2.5.5 Affordances and limitations of on-screen reading**

Digital affordances and the limitations of digital reading have been controversial subjects within the field of digital reading research. There are researchers who advocate the benefits that digital reading offers for readers, while others argue that digital reading is ineffective due to its limitations. Recently, a group of educators have realised the potential of computer technology and have demonstrated increased interest in using it as a tool to augment digital academic reading comprehension (Park et al. 2012; Labbo 2006; Day & Lloyd 2007). One digital affordance for reading is multimedia. Reinking (2001) noted that multimedia programs are not limited to textual information and can take the form of video, sound and pictures, all of which have an effective role in allowing the comprehension of digital texts. This sort of digital affordance provides digital second language readers with tools that have the potential to facilitate their L2 general, academic and technical vocabulary and also their reading comprehension (Abraham 2007). Moreover, digital readers have the opportunity to use several kinds of dictionaries or thesauri to look for word comparisons, related words, synonyms, antonyms, sample sentences, basic grammar, irregular verbs and word-by-word translations (Montelongo & Herter 2010).

Researchers also demonstrated that digital readers can easily read illustrated texts and navigate related topics as well as check information. Electronic text (via its navigational services) can aid with reading comprehension challenges that are due to limited background knowledge (Anderson-Inman

2009). For instance, readers can consult an online encyclopaedia to gain more information related to the subject under discussion (Montelongo & Herter 2010). Coiro and Dobler (2007) stated that the Internet has support tools for digital reading comprehension, such as the use of search engines to navigate multi-layered websites and monitor the appropriateness of their pathway through a complex network of connected text. Digital readers can use hypermedia technology presented in text embedded links, images, audio, video and discussion space in order to access a wider range of information. Liu (2005) stated that digital texts give the reader the choice of reading distinct parts of a text (in no particular order) and to navigate to other related sites for further information. In an early study of L2 reading with digital glosses, Lomicka (1998) conducted research on twelve college students enrolled in a French course in order to investigate the effects of multimedia reading software on reading comprehension. Lomicka (1998) found that glosses in a hypermedia played an effective role in helping students to understand the passage.

Annotations are directly integrated with printed reading material. However, electronic text has its own forms. There are a small number of existing studies that attempt to characterise or analyse markings made on e-documents. These include those undertaken by Marshall and Brush (2002) and Qayyum (2008). These studies established various kinds of annotations during electronic reading. These include: base markings; highlighting; underlining; compound markings; notes consisting of one to two sentences; cryptic expressions consisting of one to two words; symbols such as '?', '!' and numbers; circles; squares; asterisks; and stars. They also include other symbols, such as arrows, drawings, lines, and single or double lines in the margins. Moreover, Qayyum (2008) noted that the readers used electronic markings during digital reading to emphasise a passage, to separate the article into various topics or ideas and to remember certain aspects of the article that could be used in a later discussion. Digital readers also use symbols to link ideas and to create text zones for singling out similar ideas.

There have been further investigations on the positive effects of technological reading dynamics on readers' reading performance. For example, Piolat et al. (1997) noted that digital readers can increase the speed of their reading via several technical procedures. That is, they can move quickly through portions of text using the scroll bar. This also provides an approximation of the location of the reading matter, whether the reader is at the beginning, middle or the end of the text (Piolat et al. 1997). Readers can also easily and quickly move the text using page-up and page-down keys (ibid.). Further research studies have established that the ability to use large font sizes is another advantage of digital reading (Burk 2001). Moreover, different web pages can be opened

simultaneously on screen and placed either side-by-side or super-imposed upon each other. Readers can then easily switch between several windows. Szymanska and Kaczmarek (2011) stated that digital materials can be adjusted, zoomed and manipulated for comfortable and clear reading.

Chuene, Lepota and Hans (2014) mentioned three main tangible benefits that the e-text affords to readers. First, e-text has a text to speech feature which enables readers who have a visual impairment to listen to the text (Anderson-Inman & Horney 2007). Second, the portability feature of e-text, which enables readers to carry all their documents, including books and papers, in one slim machine, provides an incentive for on-screen reading (Annand 2008). Third, on-screen reading has a positive environmental effect, as it saves paper and thus trees and also cuts down on CO<sub>2</sub> (Carbon Dioxide) emissions.

Most of the previously mentioned affordances of digital reading can be summarised in line with Anderson-Inman's (2004) (Anderson-Inman & Horney 2007; Anderson-Inman 2009) eleven categories of e-text resources, namely:

1. 'Presentational Resources'
2. 'Navigational Resources'
3. 'Translational Resources'
4. 'Explanatory Resources'
5. 'Illustrative Resources'
6. 'Summarizing Resources'
7. 'Enrichment Resources'
8. 'Notational Resources'
9. 'Collaborative Resources'
10. 'Evaluative Resources'
11. 'Instructional Resources'

Anderson-Inman's e-resources model is adopted as the starting point for the current study to investigate readers' use of e-resources while reading on-screen academic texts (see 3.9.4 for further clarification and justification).

In the previously mentioned literature, e-texts are presented as support tools that enhance academic reading and comprehension; however, some researchers claim that digital reading has several drawbacks. Olive and Rouet (2008) claimed that digital reading is suboptimal and less effective than paper reading. Liu (2005) found that during digital reading, less time is spent on in-depth reading, and sustained attention. Levy (1997) maintained that digital reading is fragmented

and less concentrated. Horton et al. (1995) found that digital reading relies on flipping, scanning, browsing, selecting, and locating information in a text to get a sense of the whole document. Horton et al. (1995) believed that reading intensively is an absent feature during digital reading. Lynch (2001, cited in Chou 2012) claimed that students use digital reading materials only for browsing, checking and deciding what to read, while they print longer texts for careful and deep reading. Moreover, Shabani et al. (2012) maintained that printed documents are more suitable for in-depth reading and note taking than digital ones. They justified their claims by students' responses which demonstrated that taking notes from printed documents does not distract from the reading process, while in electronic reading, readers need to interact with the mouse and the keyboard to annotate. Dyson and Haselgrove (2000) and Brown (2001) reported that rapid scanning and skimming were most frequently used in digital reading, while detailed reading was not frequently used. It is clear that the majority of the studies mentioned above focus on the drawbacks of on-screen reading and seem oblivious to its affordances. They do not delve into its ineffectiveness when compared with paper-based reading due to characteristics such as nonlinearity, the ease of multitasking, and the manner in which it supports scanning.

However, this study argues that digital reading offers a number of important intuitive affordances that help enhance readers' reading performance. Moreover, the positive characteristics of e-text outnumber the negative, especially for L2 postgraduate student readers. These affordances of digital reading are lacking in printed text; interactivity, immediacy of accessing information, and the convergence of text, images, audio and video. Researchers may claim that digital reading is superficial and not efficient; however, this view may be because students who prefer printed reading sometimes have limited knowledge of technology's benefits and are therefore unable to take advantage of them. They may also have spent most of their previous academic career reading from printed-paper and hard copies, so when it comes to digital reading they may find it confusing and therefore reject it. The negative factors mentioned above (see Olive & Rouet 2008; Levy 1997; Dyson & Haselgrove 2000; Brown 2001; Horton et al. 1995; Liu 2005) might be eliminated if readers knew how to use and manipulate digital materials effectively. Furthermore, these drawbacks of digital reading, such as reliance on browsing and scanning, are not sufficiently significant to outweigh the benefits of digital reading for L2 academic readers. Moreover, scanning and skimming are also considered essential reading strategies, which readers need to master and practice when reading texts whether in printed or digital format.

The present study puts forward the hypothesis that on-screen reading is an effective practice capable of scaffolding (see 2.6.4) and enhancing 21<sup>st</sup> century readers' reading comprehension and learning, particularly if readers are capable of effectively employing its affordances and overcoming its challenges. An overview of previous studies on readers' reading challenges (print and screen-based) is presented in the following section.

### **2.5.6 Studies of readers' on-screen reading challenges**

In the print-based reading domain, several reading studies have investigated readers' reading challenges. These studies can be categorised as follows: studies on the reading problems of first language child readers, studies on the reading difficulties of disabled readers (Reynolds & Nicolson 2007; Vermeulen et al. 2007; Wolke et al. 2008) and studies on the reading challenges of adult first and second/foreign language readers.

However, most reading research studies have focused on identifying children's' first language reading difficulties (Chapman & Tunmer 2003; Nation, Cocksey, Taylor & Bishop 2010; Tong, Deacon, Kirby, Cain & Parrila 2011) which are not relevant for adult second language readers. Only a few research studies have been conducted to investigate the challenges that adult second/foreign language readers experience, particularly in an academic context. Brown and others (1981, cited in Chen et al. 2011) suggested two main factors that may impede readers' effective reading; insufficient prior knowledge and inadequate application of the reading strategies. Zoghi et al. (2010) investigated the degree of twelve EFL Iranian learners' potential reading comprehension failure. The researchers conducted interviews and found that three of the respondents attributed their reading problems to their limited vocabulary, while all of the participants except three referred to their difficulties with determining the main ideas in the text, connecting ideas and locating them in the text. Chawwang (2008) investigated the English reading problems of Thai students. The participants, composed of eight hundred and forty students studying in grade 12, from Science and Arts programs, were asked to take a reading test to determine their English reading ability. The test was divided into three parts; sentence structure, vocabulary and reading comprehension. The researcher analysed the scores obtained from the test and found that most of the participants, both Science and Arts students, were unable to give the correct answers to the English reading test, which indicates that they had problems in three areas of the reading test; sentence structure, vocabulary, and reading comprehension.

Hayashi (1999) conducted a study on one hundred EFL Japanese students to investigate their L2 reading strategies and reading comprehension difficulties. The researcher used reading passages

selected from newspaper articles and a questionnaire to examine the participants' reading strategies. It was found that the students had problems with reading the passages and the questionnaire revealed that students' main difficulties with reading comprehension were with grammar, vocabulary and a lack of prior knowledge. Asraf and Ahmad (2003) studied the reading habits of three classes of 7th-grade students in rural schools in Malaysia through the Guided Extensive Reading program. The participants were students in one class of 9th-grade students in Malaysia. The researchers observed and videotaped the classrooms every week for four months during the first school term. They also used teachers' diaries to analyse the participants' reading habits. It was found that the main two problems encountered by the students was lack of vocabulary knowledge and an inability to guess the meaning of words in the context. Nassaji (2003) also examined the accuracy of twenty-one intermediate ESL learners' word inferences when they encountered unknown words. The researcher used introspective, retrospective think-aloud protocols and a reading passage which contained three hundred and seventy-four words. Ten target words were used to focus on inference strategies. Nassaji (2003) found that guessing word meaning from context in a reading text was a difficult skill. That is, over 55% of the participants could not infer the meaning of new words from context.

Chaichanasiri (2007) conducted a study to investigate the common reading problems of one hundred and ten Thai computer professionals with using English texts based on their field of study. A questionnaire was designed and used as an instrument to investigate the common reading problems encountered by the participants. The data were analysed using the frequency and percentage. The researcher found that all Thai computer professionals encountered some sort of reading problem related to vocabulary, sentence structure, technical terms and/or insufficient knowledge of subject matter. Technical terms, vocabulary and sentence structure were found to be the most frequent problems encountered by Thai computer professionals. The results revealed that 42.9% (60) of the participants encountered problems with technical terms, followed by vocabulary problems for 36.4% (51) and then by sentence structure problems for 34.3% (48). Wongwaiyut (2011) studied the reading problems of thirty international trade staff at the Sumitomo-Mitsui Banking Corporation, Bangkok Branch. The researcher used a questionnaire as a research instrument to investigate the problems encountered while reading. The analysis of the data showed that the international trade staff at the Sumitomo-Mitsui Banking Corporation mainly encountered general vocabulary problems when reading English. Surprisingly, the participants rarely found that they encountered reading problems related to technical terms for business, complicated sentence structures or insufficient knowledge of the subject matter.

To sum up, previous studies (Chaichanasiri 2007; Wongwaiyut 2011; Nassaji 2003; Asraf & Ahmad 2003; Chawwang 2008) revealed that there are several factors which cause problems and act as barriers to L2 readers' reading comprehension, namely:

1. Insufficient vocabulary (general and technical)
2. Inability to infer word meaning from the context
3. Lack of mastery of L2 sentence structure
4. Lack of content previous knowledge

However, such research studies were focused on investigating specific problems, such as vocabulary, sentence structure and content knowledge via structured questionnaires. Few of these studies used open-ended interview questions to allow the readers to report the reading problems they encountered when reading L2 printed academic texts. Moreover, none of these studies investigated the reading challenges faced by postgraduate students when reading research articles in their field of study. They also neglected other crucial factors, which may cause problems for L2 readers, for example, the readers' previous reading experience, previous reading education and the reading demands of the current educational environment. Most importantly, these studies did not investigate the difficulties that hinder readers when reading academic texts on-screen. That is, most research studies have not examined the challenges of on-screen reading in much detail.

A few research studies have partially highlighted some of the challenges that readers might experience while reading on-screen. One on-screen reading challenge is cognitive overload caused by screen-based reading which impedes information processing and leads to ineffective reading comprehension and learning (Pearson et al. 2013; Sandberg 2014). Mangen, Walgermo and Brønnevik (2013); and Borodin, Bigham, Dausch, Ramakrishnan and Brook (2010) mentioned cognitive overload as being a challenge that screen readers might experience during interaction with e-text due to the multitasking feature and the fact that more than one screen can be viewed at a time. Similarly, Sandberg (2014) addressed some of the challenges that readers may experience during reading on-screen text, including cognitive overload and discouragement resulting from eyestrain problems, the strangeness of reading on-screen and of navigation. Chen (2010) demonstrated how navigating between the links during on-screen reading could create difficulties with information processing while reading. Lee and Tedder (2003) demonstrated that on-screen reading could hinder readers' information recall and cause disorientation in their learning process because of the navigation feature of screen texts. One study found that distraction and fragmented reading resulted from multitasking and links provide a challenge to on-screen readers during interaction with the text (Carr 2010). According to Sandberg (2014), readers are unable to perform effectively with the multitasking

feature of on-screen text and thus, they find on-screen reading challenging as they are constantly distracted and cannot concentrate.

Rose (2011) labelled six on-screen reading challenges in her study; ‘disappearing page’, ‘to have but not to hold’, ‘the ever present screen’, ‘getting in focus’, ‘the disciplined body’ and ‘finding what I need’ (p.218 - 523). Duran (2013) analysed students’ replies to a survey assessing their on-screen reading challenges and found that a good number of readers reported backache and eyestrain brought on by on-screen reading. Similarly, Annand (2008) reported that readers complained of eyestrain and fatigue as a result of screen reading. Likewise, Chou (2012) found that one of the readers’ biggest problems during on-screen reading was eyestrain.

Other screen reading challenges are related to the possibility of annotating and the application of essential strategies that readers are accustomed to employing during print-based reading, such as highlighting, underlining and taking notes. Annand (2008) reported on readers’ frustration at their inability to annotate while reading on-screen. Likewise, Liu (2005) found that readers find it challenging to use annotating strategies, such as highlighting and underlining when on-screen reading. Drawing from these previous studies (Chou 2012; Annand 2008; Duran 2013; Rose 2011; Carr 2010; Sandberg 2014) which have investigated either print or digital reading; the researcher in the current study has summarised the most common reading challenges (see Table 1).

<b>Reading Challenges</b>	
<b>On-screen reading challenges</b>	<b>Print-based reading challenges</b>
<ol style="list-style-type: none"> <li>1. Cognitive overload</li> <li>2. Navigation feature of screen texts</li> <li>3. Behavioural issues</li> <li>4. Physical issues</li> <li>5. Digital strategies applications</li> </ol>	<ol style="list-style-type: none"> <li>1. L2 language proficiency</li> <li>2. Reading strategy application</li> <li>3. Content knowledge</li> </ol>

Table 1: Reading challenges (on-screen and print-based)

However, the current study extends the research into on-screen reading challenges and their causes by conducting a qualitative in-depth investigation of the reading challenges faced by postgraduate students who have come to a new context when they are required to read L2 research articles on-screen in their field of study, using think-aloud protocol, stimulated recall and interviews (see 4.7 for readers’ reading challenges and 6.3 for their discussion).

## 2.6 Reading: Cognitive and/or contextual

A review of the literature reveals that there is a debate between cognitive and socio-cultural perspectives relative to second language learning and acquisition. The cognitive view primarily focuses on the mental processes of learners' learning, acquiring and constructing language (Larsen–Freeman 2007; Mason 2007; Wadsworth 1979). It focuses on the cognitive factors associated with learning, processing and recalling knowledge. It is based on the fact that the learning process occurs in relation to an individual's mental state. It is founded on the understanding that learning takes place within a social context and even if a context changes, the acquisition and learning processes do not (Larsen–Freeman 2007) (see 2.6.1 for further details). On the other hand, the socio-cultural view, introduced by Lev Vygotsky advocates that human mental activity is essentially a mediated process, which is both socially and culturally constructed (Holzman & Newman 2007; Minick 2005; Lantolf 2000). The context is therefore viewed as a crucial element of the learning process. Learning development occurs in and is shaped by social and contextual cues that affect the learner's environment. This view emphasises the fact that language is socially constructed and learning occurs through social participation in response to environmental stimuli (Kozulin 1996 & Ortega 2009) (see 2.6.4 for further details).

For several decades, research concerning reading has extensively relied on cognitive viewpoints from which to study and understand the reading process. Numerous studies have investigated L1 and L2 reading from the cognitive perspective held by Piaget (Wadsworth 2004). According to this perspective, the reader and the text are the central elements of the reading process (Alexander & Jetton 2010; Kintsch & Kintsch 2005; Grabe 2012). This reading literature has demonstrated that the role of cognitive perspective in reading research cannot be denied, as it provides a basis for understanding how the mind works and the ways in which individual performance is constructed in the reader's brain, along with the ways this mental process works and develops.

Therefore, by drawing on initial perspectives in the current study, it is necessary to explore the cognitive reading process and factors which have a bearing on the construction of postgraduate students' current reading practices within the UK educational context. This includes their L2 academic reading strategies and the challenges that they experience when reading L2 academic texts in their field of study. It also makes it possible to outline the ways in which the quality of their reading practices changes over time.

However, arguably relying on the cognitive perspective alone, and following the route taken in previous reading research, is not (for a number of reasons) fully sufficient to provide a picture of

reading comprehension in any group of L2 readers. The cognitive reading literature presents reading in a relatively limited way by focusing on cognitive processes, strategies and knowledge. It neglects the socio-cultural factors that contribute to constructing and transforming readers' performance, i.e. variations in readers' abilities are not due solely to individual cognitive variables and their development; they are also related to social and cultural factors and readers' participation in specific contexts. According to more recent studies, reading should not be viewed merely as a cognitive skills-based activity but rather as a social practice situated within a socio-cultural context (Baker 2010 & Mills 2010). The majority of social researchers argue that learners' cognitive functions stand in relation to the social environment in which they occur (Valsiner & Veer 2000; Salomon & Perkins 1998). These comprise of the author, the text, the reader and the context. In addition, the cognitive perspective views learners' learning processes as solely mental functions. This is not so: the learning process is also a result of learners' participation in specific contexts (Gee 2010). Therefore, in the present study, the researcher argues that it is essential to draw upon a further perspective, one that views learners as part of a context and emphasises the role of such context to add to and compensate for the limitations of the initial perspective.

The second perspective framing the current study is socio-cultural. This is drawn upon in the current study due to the limitations previously noted concerning the first perspective (the cognitive) for fully exploring factors that affect the academic reading practices of specific groups of postgraduate students studying in an unfamiliar educational context. Although a socio-cultural perspective has no direct impact on understanding the actual cognitive processes of a reader, such as understanding the manner of reading strategies employed, the cognitive process of reading development and the role of linguistic knowledge in reading comprehension, this perspective can provide a deeper understanding of reading practice. It focuses on the social and cultural factors that influence reading behaviour and practices. These include home, education and interactions between peers, experts and technology. This aspect is concerned with questions such as 'how much', 'what', 'why', 'where', 'when', and for 'how long' people read (Gee 2010). Considerable research has been conducted on the social factors influencing L1 reading, i.e. home environment; socio-economic; ethnic and community (Silvia et al. 2010; Baker and Scher 2002; Goldenberg et al. 2006; Snow et al. 2007). However, there is considerably less research focusing on the role of social factors in the L2 academic reading process and development (Gao 2006), and no research has been specifically concerned with readers who are studying within the UK. The current study therefore aims to add to the field of second language reading research by highlighting some of the socio-educational factors related to second language readers' cognitive reading comprehension (see 6.5.3).

In summary, this study argues that drawing on a cognitive or socio-cultural perspective in isolation cannot fully represent the actual reading performance of a group of readers in a specific context. When conducting research into reading, it is necessary to combine these two perspectives, in order to form a coherent educational theory.

### **2.6.1 Cognitive reading approaches**

This study defines cognitive approaches as mental actions that include a wide range of processes and strategies employed by individuals, either consciously or unconsciously, to achieve specific purposes. The definition of cognitive approaches in the current study is narrowed to cognitive reading approaches, in which individuals use specific reading strategies (see 2.5.1) and processes to achieve specific reading purposes, such as comprehension, learning and writing.

In order to address the issue of reading in L2, the processes and the theories that have been established and developed in first language reading must be highlighted, as many of these processes and theories were derived from initial research concerning L1 reading to reading in L2 (Alderson et al. 2014). Grabe and Stoller (2011) distinguished between two approaches to reading; metaphorical and specific. The metaphorical approach to reading comprises a bottom-up process, a top-down process and an interactive process. Specific approaches to reading include an interactive compensatory process, a word recognition process, a simple view of reading process, dual-coding models and a psycholinguistics guessing game process.

The following section discusses the elements of the cognitive perspectives approach adopted in the current study in order to scrutinise readers' on-screen L2 academic reading. The metaphorical approach comprises three reading processes:

1. Bottom-up
2. Top-down
3. Interactive

This study considers L2 academic reading to be a process that involves an interaction between top-down and bottom-up processes, as L2 reading comprehension seems to require multiple levels of processing. It is essential to note that second language readers' comprehension of words, sentences and entire texts involves not only linguistic knowledge but also knowledge of the world and is also dependent on the background of the reader. Furthermore, it seems that it is much more challenging for readers to read and comprehend an L2 text based on the strengths of either the top-down or the bottom-up process alone. It is necessary to use both techniques in order to fully comprehend a written text. Although the processes involved in on-screen reading require further investigation, a

considerable body of literature has demonstrated the role of the interactive process in L2 print based reading (Carrell et al. 2000; Chun & Thompson 2008; Zhang 2008; Hellekjær 2009). The researcher also in the present study argues that both kinds of reading processes; top-down and bottom-up are based on the readers' own knowledge of interacting with the content of the text during on-screen reading. This comprises both knowledge concerning the language in question and the content. Thus, it is essential to highlight the constructivist perspective, including schema theory that presents the different forms of readers' knowledge (see 2.6.3) following the discussion of reading processes which follows.

### **1. Reading as a bottom-up process**

The bottom-up model has existed since the 1960s, and it emphasises that L1 readers, taking reading materials as information input, start from letter, sound and word recognition and then combine information continuously to accomplish a reading task (Dambacher 2010; Hedgcock & Ferris 2009). This model highlights the fact that reading must be completed in a fixed sequence to comprehend word meaning gradually and assumes that readers comprehend the reading materials mainly by language knowledge. It is also associated with behaviourism and phonic approaches that emphasize that reading should start by enabling readers to recognize letters and sounds (Alderson 2000). That is, readers register the letters and then decode them into phonemic units. According to the bottom-up theory, comprehending a text depends on a process of decoding grapheme to phoneme, whole word recognition, noticing morphemes, and dividing words into morphemes. Wallace (2001) claimed that there is a strong link 'between phonemic awareness, the ability to process words automatically and rapidly, and reading achievement' (p.23).

The bottom-up reading process is based on building readers' cognitive sub-skills, such as word recognition, spelling and phonological processing and lexical recognition (Hudson 2007). This enables readers to gather all the visual information from the written text to identify the meaning of words and then the meaning of larger syntactic units, such as phrases, clauses and sentences (Dambacher 2010). Birch (2007) also advocated that the bottom-up process is a fundamental process that has effective results on readers as it begins with processing letters, morphophonemic and leads to vocabulary learning and understanding. Moreover, the bottom-up process enables L1 readers to identify short phrases, analyse them syntactically and understand collocations. It also includes the process of linking pronouns with their referents, subordinate clauses with their main clauses and noticing textual clues such as punctuation (Macaro & Mutton 2009).

However, other researchers have argued that this picture does not reflect the actual reading process in second language contexts. For instance, Nunan (2000) argued that 'we don't process print in a serial, linear, step by step way. Nor do we process print as a visual tape-recorder' (p.256). Eskey (1973, cited in Carrell et al. 2000) also claimed that the decoding model was inadequate because it 'underestimated the contribution of the reader' (p.3) and it failed to recognize the reader's expectations about the text that were based on their knowledge of language and content. This indicates that the bottom-up model places more emphasis on the written or printed text and the readers are put in a fairly passive position in which they decode whatever is written in the text in a mechanical way. It is only concerned with interpreting and excludes reader's knowledge and background experience. Therefore, relying solely on these techniques would not be effective for the L2 reader to comprehend the written text. That is, it has several drawbacks; slow reading due to re-reading, vocalizing, language interference and misunderstanding due to heavy reliance on translation (Dambacher 2010).

## **2. Reading as a top-down process**

Due to the perceived deficiency of the bottom-up model, theorists such as Widdowson (1983); Goodman (1967), and Smith (1994, cited in Hudson 2007) began to view second language reading as an active process in which the reader is an active information processor who predicts while sampling only parts of the actual text. Goodman (1967) and Smith (2004) claimed that reading is not primarily a process of picking up information from the page in a letter-by-letter, word-by-word manner. Rather, they argued that reading is a selective process. Since it does not seem likely that readers have the time to look at all the words on a page and still read rapidly, it makes sense that readers use the knowledge that they bring to the text and then read by predicting information and confirming or disconfirming these predictions. Smith (2004) also concurred with Goodman's arguments that sampling is effective, in which readers encode part of the text, predict, draw hypotheses and make judgments because of the extensive redundancy built into the abilities of readers to make the necessary inferences from their background knowledge. Hence, the reader contributes more than the visual symbols on the page.

On the other hand, Rumelhart (1977, cited in Tracey & Morrow 2012) and Stanovich (1980, cited in Bernhardt 2011) argued that the top-down approach has procedural problems; for example, it is possible that the reader has little knowledge of the topic and cannot generate predictions. In this case, a top-down reading approach is not sufficient to comprehend a written text. Another drawback of the top-down process is that a reader takes much longer to generate predictions than to recognize words. Another argument against the top-down technique is that it tends to emphasize

higher level skills, such as the prediction of meaning by means of contextual clues or background knowledge, at the expense of lower skills like the rapid and accurate identification of lexical and grammatical forms (Eskey & Grabe 1988). In this vein, Smith (2004) argued that good reading is a more language-structured affair than the guessing-game metaphor seems to imply. This reading process is good for the skilful, fluent reader, for whom perception and decoding have become automatic, not for the less proficient, developing reader and second language (L2) reader.

Despite these objections, the top-down model still is valid and effective in second language reading comprehension. Clearly, the top-down reading model has its own advantages and plays an essential role in second language academic reading comprehension. However, reading researchers (such as Carrell 1988) argued that the process of reading should involve the two processes; top-down and bottom-up and advocate an interactive approach to reading.

### **3. Reading as an interactive process**

The interactive model developed in the late 1970s and early 1980s. The appearance of this model has made clear that effective and efficient reading requires both top-down and bottom-up models operating simultaneously (Hudson 2007; Hedgcock & Ferris 2009; Alderson et al. 2014; Shiotsu 2009). Here, low-level 'bottom-up' processes involving the text, such as letters and words, interact with higher-level 'top-down' processes including prior knowledge of the text or subject (Carrell 1988). The reader therefore engages with all types of processing simultaneously, although only one source of meaning can be the principal one at a given time (Dechant 1991). For instance, prior knowledge of the text subject could be sufficient to help the reader recognize a word. Alternatively, pronouncing a word aloud might help a reader to derive the meaning of an unfamiliar word. Readers engage with what is on the page, as well as with their prior knowledge. The higher-level cognitive processes involved in reading, in conjunction with the lower level processes, are essential for effective reading as they form the cognitive processing faculties that give readers the ability to read for different purposes (Hudson 2007 & Grabe 2012).

In a similar vein, Maybin and Moss (1993) stated that in an interactive approach, the text, society, context and politics all affect readers' process of meaning making. That is, comprehending text requires readers' linguistic knowledge, such as decoding words, sentences and the meaning of entire texts, and as Anderson et al. (1977) stated 'every act of comprehension involves one's knowledge of the world as well' (p. 369). The interactive model is based on the interaction between reader's thoughts and language (Carrell 1988). That is, the reader brings to the text certain information, ideas

and beliefs. This knowledge coupled with the ability to make linguistic predictions influence reader's expectations during the reading process (Ajideh 2003).

Relating the previously mentioned existing reading comprehension strategies (see 2.5.1) to the reading processes demonstrates the link between existing reading comprehension strategies and the interactive reading model involving features of both (bottom-up and top-down) (see 3.9.3). These cognitive reading strategies are based on the two previously mentioned general reading approaches. First, bottom-up (the main focus is on textual decoding), which includes scanning to find specific information, analysing sentence structure, and understanding punctuation use within a text. Second, top-down (the main focus is on the reader's interpretation and prior knowledge), which includes using prior experience and knowledge, guessing the content of a text and drawing inferences.

### **2.6.2 Constructivism and reading**

Piagetian constructivism is based on 'Each individual over the course of his development constructs knowledge and reality' (Wadsworth 1979, p.132). Piaget's research provided relevant information to education, learning and teaching as it was directed towards understanding knowledge acquiring and intellectual development of children (Wadsworth 1979). Constructivism is a theory of learning and development that emphasises the active construction of knowledge by the learners (Gunning 2015). According to this theory, learning originates when individuals integrate new knowledge with previously existing knowledge. This integration ensues naturally and continually when the learner is actively involved in the learning process. The constructivism theory has three main aspects (Tracey & Morrow 2012). First, it is an internal mechanism, that is, the learning occurs internally and the external viewer does not often observe the learning process. Second, it is based on the testing hypothesis, where learning occurs as a result of examining new experiences on the basis of previous experiences. Third, learning is the result of an inferencing process in which the readers attempt to comprehend written text by filling the gaps using their previous knowledge and experience. Thus, according to the constructivist theory, readers construct their text comprehension and learning based on their previous knowledge. This knowledge is presented as schemata in readers' brains that are presented in detail in the following sections.

### **2.6.3 Schema theory in reading**

Piaget asserted that 'the mind had to have structures [schema] much in the same way the body does' (Wadsworth 1979, p.10). Schema is a technical term used by cognitive psychologists in order to describe learners' knowledge and the ways in which it is processed, organised, stored and utilised

(Yu-Hui et al. 2010). Bottom-up processes and top-down processes (mentioned in 2.6.1) are activated based on readers' schemata, language knowledge and/or content knowledge during interaction with the text content. From this viewpoint, reading is directed by the written text that influences the reader to construct meanings based on her/his previously acquired knowledge (Zhao & Zhu 2012; Yu-Hui et al. 2010; Alderson 2000; Huang et al. 2009). Readers' comprehension of a text depends on the amount of related schemata they have at their disposition and can employ while reading, i.e. the failure of L1 or L2 readers to comprehend a written text may well be due to their lack of an appropriate schema (Lin 2002; Al-Issa 2011; Landry 2002; Carrell & Eisterhold 1983; An 2013). Readers with good background knowledge can generally predict more easily what comes next in a text than readers with less background knowledge. Such knowledge could, therefore, enhance reading comprehension (Alfassi 2004; Meneghetti et al. 2006; Yu-Hui et al. 2010).

Schema theory has a number of important characteristics. First, learners have schemata for everything in their life, i.e. an individual with a schema concerning dogs includes everything they know about dogs, such as places and issues (Tracey & Morrow 2012). Second, a schema is highly individualised. For example, individuals in the habit of sailing possess more schemes for boats and issues concerning travelling on water than those who are not (Ibid.). Third, knowledge structure or schemata is flexible and adaptable (Woolley 2011), i.e. an individual's existing knowledge can change and develop.

In schema theory, the background knowledge that readers utilise during their engagement with the reading text has been classified into two types that are going to be discussed in the following two sections:

1. Content schemata (focusing on readers' prior knowledge concerning the content of the passage) (Yu-Hui et al. 2010; Huang et al. 2009).
2. Formal/Language schemata (focusing on the linguistic knowledge of the reader).

However, it is argued in this study that content and language schemata are not yet sufficient to enable readers to interact successfully with text on-screen. Readers require new forms of schema, namely knowledge of how to interact with digital text presented on-screen, and to be able to make use of digital affordances to enhance their on-screen reading comprehension. A third kind of schemata, namely digital schemata, should thus be introduced to the field.

The following sections present the schemata that have been explained in the literature and illustrate their role in reading comprehension.

## 1. Content schemata

Content schemata comprise the reader's background knowledge and familiarity with the content of the text. According to schema theory, comprehending a text is an interactive process between the reader's background knowledge and the text (Carrell 1987). McCullough (2008) exemplified the role of the reader's prior content knowledge in comprehending a written text by stating that:

'A person who knows the word 'jibed' is likely to have knowledge of sailing that enables him or her to construct meaning while reading the following sentence: We jibed suddenly and the boom snapped across the cockpit. Students who had no knowledge of sailing and were asked to read that sentence would be operating without sufficient prior knowledge and thus would be at a disadvantage' (p.7)

The effect of readers' knowledge of the content on reading performance has been investigated widely in the fields of first and second language reading. A number of researchers have stated that content knowledge and topic familiarity play a crucial role in L1 and L2 reading comprehension (Erten & Razi 2009; Alptekin & Erçetin 2011; Li & Lai 2012).

Garth-McCullough (2008) conducted a study on eighth-grade students born in the United States of America and of African-American descent, in order to explore the effect of readers' prior knowledge of text content. There was a particular focus on the effect of cultural literature knowledge on reading comprehension. The researcher established that students' levels of prior cultural knowledge of the content of African-American stories significantly influenced their L1 reading comprehension performance. A further study conducted on L2 reading by Ahmadi (2007) investigated the effects of content schemata on reading comprehension and recall with two hundred Muslim Iranian male students of English as a foreign language (EFL). The researcher used two different types of texts: (1) content-familiar text (an extract from the biography of the Prophet Muhammad); (2) content-unfamiliar text (an extract from the biography of Joseph Smith, a non-Muslim religious figure). The results indicated a significant effect of familiarity with the content on the reading comprehension and recall of the participants. These research studies focused on measuring the effect of readers' prior knowledge on reading comprehension by the use of reading comprehension texts followed by questions to measure understanding of the content. Although such tests produce reliable results, none of the studies investigated readers' perceptions of the connection between their subject-related knowledge and their reading comprehension development and reading challenges. Few studies have measured readers' perceptions of the effects of their content knowledge on their reading comprehension. For example, Li and Penghu (2012) used a survey to measure participants'

attitudes toward the role of background knowledge in their reading process. The participants agreed that background knowledge played a significant role in their reading comprehension process and that it facilitated their comprehension of the reading texts.

The results from previous research studies clearly illustrate the importance of culturally bound prior knowledge for enhancing readers' reading comprehension. However, these research studies focused solely on investigating specifically cultural knowledge in order to enhance the reading of a cultural text. Few studies exist (Uso-Juan 2006; Khosrojerdi 2011) which have focused on measuring and exploring the effect of readers' subject-related knowledge on their reading and comprehension in that particular subject. For example, the experimental study of Alemi and Ebadi (2010) with groups of engineers which was conducted to investigate the effect of pre-reading activities and prior knowledge of their subject area when reading an engineering text established that the group with subject-related pre-knowledge understood the text better than the group without. However, these studies were carried out in a pedagogical context, where researchers prepared the control group by supplying them with related information concerning the written text. Furthermore, they did not investigate the students' own views concerning the development of their academic reading comprehension in relation to their background subject knowledge.

## **2. Formal schemata**

Formal schemata are the readers' prior linguistic knowledge of the text and level of proficiency in a second language. They comprise the readers' ability to identify the linguistic elements of the written text, such as letters, phoneme, grapheme, words, phrases, sentences and metalinguistic and rhetorical knowledge. Reading researchers advocate the importance of readers' language schemata for their ability to read and comprehend a written text (Guo & Roehring 2011; Zhang 2008; Zhao and Zhu 2012; Alderson 2000). This current study draws on three elements of formal schemata; rhetorical, vocabulary and grammatical knowledge, due to the fact that they are the linguistic factors which have been most intensively investigated and have a proven role in readers' second language reading comprehension (McVee et al. 2013). The following section presents in detail the positive role of L2 a) rhetorical, b) vocabulary and c) grammatical knowledge in L2 reading.

### **a. Rhetorical knowledge**

Rhetorical knowledge comprises the readers' knowledge concerning discourse structure, the macrostructure and the logical organisation of a reading text (Alderson 2000 & Sharp 2002). This includes understanding where to look for the main ideas and being able to identify where details

occur. Five types of formal discourse schema have been established: (1) contrastive schema; (2) cause-effect schema; (3) problem-solution schema; (4) procedure schema; and (5) descriptive schema (Meyer & Freedle 1979, cited in Ferdosipour & Delavar 2011). Each of these possess distinctive features that the majority of readers should be able to identify in order to improve their reading text comprehension (Carrell 1987).

Reading research suggest that readers who are familiar with the rhetorical organisation of the reading text are more efficient when it comes to reading and understanding (Grabe 2012; Hudson 2007; Koda 2005; Yu-Hui et al. 2010). Earlier studies investigated the effect of teaching different rhetorical structures on the improvement of students' reading comprehension. For instance, Sengupta (1999) conducted a study on the ways in which developing rhetorical consciousness among L2 students influences their reading skills. He established that raising students' rhetorical consciousness develops their L2 reading comprehension and enables them to successfully discuss text content. A study by Koda (2005) also demonstrated that knowledge of text structure and type enables L2 readers to identify more efficiently the main ideas of both the entire text and its individual paragraphs. Learners are also better able to distinguish between main ideas and supporting details, and to comprehend the ways in which the components of the text (i.e. opening and closing paragraphs, discourse markers and other text signposts) create a cohesive text (Ibid.).

These research studies indicate that readers' knowledge and awareness of a written text's rhetorical structure have a significant impact on reading comprehension. L2 readers are able to comprehend the text content more easily and effectively if they are aware of the text's rhetorical structure. An analysis of genre in reading and investigation of the effect of different rhetorical structures among disciplines and their relation to readers' reading strategies is discussed in detail in 2.5.4.

#### **b. Vocabulary knowledge**

Vocabulary knowledge in L2 reading comprises the L2 vocabulary that readers know, recognise and understand (Shiotsu 2010). Researchers have proposed a number of complementary frameworks in order to define readers' vocabulary knowledge. They have suggested that it involves degrees of knowledge. For example, Carlisle (2007) reported that vocabulary consists of four dimensions: (1) vocabulary size; (2) knowledge of word characteristics; (3) lexicon organisation and (4) processes of lexical access. Henriksen (1999) proposed three further dimensions of vocabulary knowledge: (1) partial-precise knowledge; (2) depth of knowledge and (3) receptive-productive knowledge. Qian (2002) also suggested that vocabulary knowledge consists of four interconnected dimensions: (1)

vocabulary size; (2) depth of vocabulary knowledge; (3) lexical organisation and (4) automaticity of receptive/productive knowledge.

The above-mentioned dimensions reveal that vocabulary knowledge consists mainly of two aspects: vocabulary breadth and vocabulary depth. Vocabulary breadth consists of the knowledge of multiple meanings of words, but is not concerned with how well each of these words is known to an individual (Guo & Roehring 2011; Shen 2008). Readers may be familiar with a considerable number of words but it may only be superficial knowledge. A number of research studies have attempted to estimate the number of words that L2 readers require in order to comprehend a text. Laufer (1997, cited in Hatami & Tavakoli 2013) reported that for minimum comprehension, L2 readers require around three thousand word families or five thousand individual word forms. Nation (2006) proposed a more recent explanation of vocabulary size required to read English texts. His estimation is considerably higher, arguing between eight and nine thousand word families are needed for fluent reading in English.

Vocabulary depth, on the other hand, refers to the richness of vocabulary knowledge possessed by readers. Depth of word knowledge includes knowledge of the base meaning of the word, as well as the ways in which it changes in different contexts (Stahl 1998, cited in Guo and Roehring 2011). It also covers the following components: pronunciation, orthography, meaning associations (synonyms, antonyms and hyponym), parts of speech, register and frequency; and morphological, syntactic and collocational properties (Shen 2008).

Researchers also distinguished between two further groups of vocabulary knowledge: (1) general L2 vocabulary knowledge and (2) technical/field specific vocabulary knowledge (Nation 2001; Chung & Nation 2003). General vocabulary knowledge comprises readers' knowledge of the most frequently used words in English texts, while specific vocabulary knowledge is readers' knowledge of less frequently used words. They are technical and 'difficult' words appearing in a text related to a specific field of study (Mehrpour & Rahimi 2010).

Vocabulary knowledge is now recognised by a number of researchers as a critical feature of reading ability and a major determinant influencing reading comprehension in ESL/EFL (Abraham 2007; Alderson et al. 2014; Golkar & Yamini 2007; Nagy, Verninger & Abbott 2006). This establishes that the ability of a second language reader to comprehend texts is reliant on their ability to decode words, analyse their morphemic strategies, understand their synonyms or antonyms' or decode

them according to their relation with other words within a context. Kolic-Vehovec and Bajšanski (2007) stated that a reader's ability to identify words within a text is an indication of a skilful reading.

Empirical studies focusing on the relationship between readers' knowledge of vocabulary and L2 reading comprehension have consistently produced a strong correlation between the two (Guo & Roehring 2011; Mehrpour & Rahimi 2010; Pulido & Hambrick 2008; Schmitt et al. 2011). For example, Mehrpour and Rahimi (2010) studied the effect of both Iranian EFL readers' general and specific vocabulary knowledge on their reading comprehension performance. Two groups participated in the study. The treatment group were given a reading comprehension test accompanied by a glossary, which included the meanings of the most difficult words appearing in the test. The control group received the same test but without the glossary. The researcher established that the results of the reading comprehension test of the students in the treatment group significantly outperformed the results of the reading comprehension test of the control group. This indicates that readers' general and specific knowledge of vocabulary has an effect on their reading comprehension performance.

Schmitt et al. (2011) investigated the relationship between the percentage of vocabulary coverage and the percentage of reading comprehension. The participants completed a vocabulary measure based on words drawn from two texts. They then read the texts, and completed a reading comprehension test for each text. The researchers established that there is a linear relationship between the percentage of vocabulary known and the degree of reading comprehension. That is, the more vocabulary the readers have, the greater the level of comprehension they achieve. Guo and Roehring (2011) explored the contributions of L2 vocabulary knowledge to the L2 reading comprehension of adult Chinese-speakers learning English as an L2. The participants were undergraduate students enrolled in English Education majors at three universities in China, where their major courses were taught in English. The participants were given two tests of vocabulary knowledge in their original English language versions. They were subsequently given the TOEFL Reading Comprehension subtest (TOEFL-RBC) and a reading test to assess their reading comprehension. The analysis of the data revealed that participants' L2 language-specific knowledge (vocabulary) was a significant predictor of their L2 reading comprehension.

A notable finding of these studies is the significant correlation between L2 vocabulary knowledge and L2 reading comprehension for L2 readers. However, previous studies have not investigated the effect of vocabulary knowledge development on academic reading comprehension amongst second language postgraduate students during on-screen reading. Moreover, previous research studies used quantitative measures to investigate the effect of readers' vocabulary knowledge on their

reading comprehension, but none investigated readers' perceptions of the role of their vocabulary knowledge and its development on their reading performance during their postgraduate studies and particularly the role of digital affordances in relation to vocabulary comprehension during on-screen reading.

### **c. Grammatical knowledge**

L2 grammar knowledge plays a fundamental role in L2 reading comprehension (Alderson 1993; Alderson et al. 2014; Kuhn & Stahl 2003). It is a reader's ability to parse sentences into meaningful phrases, identify the syntactic roles of words, dissect sentences into meaningful chunks, and recognise the syntactic structure of a sentence (Kuhn & Stahl 2003). A number of research studies have demonstrated that knowledge of language structure assists L2 readers to achieve more efficient reading skills (Alderson 1993; Hemmati & Bemani 2013; Kuhn & Stahl 2003; López 2008; Jung 2009). For example, Alderson (1993) reviewed data from the English Language Testing Services (ELTS) revision project and noted a considerable overlap between scores on the grammar and reading tests. This led him to propose a significant role for grammar in L2 reading. López (2008) investigated the effect of readers' grammar knowledge on reading comprehension in one hundred and eighty six Spanish university students. Two major sets of tests were used. One focused on reading comprehension, the other on knowledge of grammar. The researcher analysed the data through linear regression analysis in order to determine the correlation between readers' reading comprehension and their grammar knowledge. The results demonstrated that there is a statistically significant relationship between the participants' reading comprehension and grammar knowledge, establishing the role that grammar knowledge plays in advanced reading comprehension.

Other L2 reading research studies have investigated the role of readers' grammar knowledge in L2 reading by comparing the relative importance of grammar with L2 vocabulary knowledge (Khodadady et al. 2010; Shiotsu & Weir 2007). These recent studies measured the effect of vocabulary and grammar knowledge on readers' reading comprehension via quantitative methods. Using tests and statistical analysis, they measured the correlation between learners' grammatical knowledge and their L2 reading comprehension ability. However, none of the previous studies have compared the role of grammar and vocabulary knowledge with readers' own perceptions, and how readers could develop these kinds of knowledge in a L2 on-screen reading context using the digital affordances.

The following section presents reading from the second perspective taken in this study that is the sociocultural perspective. It reviews the role of readers' educational context in their academic reading practices.

#### **2.6.4 Social constructivism**

Social constructivism has gained considerable momentum in the field of second and foreign language learning. It is related to Vygotsky's ideas of sociocultural theory which is based on the concept that all knowledge is constructed socially (Pritchard & Woollard 2010). Social constructivism views learning as an active process in which the learner's social active interaction is highly significant (Packer & Goicoechea 2000). It perceives the progress of learners in terms of the influence of experience and previous practices in a specific context. It also stresses the importance of the learner's social interaction with knowledgeable members of their society as well as with others (Tracey & Morrow 2012).

Learning, according to the social constructivist approach is based on cognitive and sociocultural aspects. The social constructivist holds that knowledge is embedded in individual activities within a social context (McMahon 1997; Tracey & Morrow 2012). It emphasises the role of both 'endogenous' and 'exogenous' factors. The former represents internal schema (see 2.6.3) and the latter the social and cultural variables that influence and transform the learners' internal schema (Cole 1990, cited in Kaufman 2004). Hence, learning involves several elements that interact simultaneously; for example, the learner's culture, society, background knowledge, social interaction, motivations and language. Thus, from the social constructivist's viewpoint, the learner is an interactive individual (Rovai 2004). Learners utilise previous input to construct meaning from social interaction. Social constructivism also emphasises the concept that individuals gradually build their own learning and internal schema through experience, maturation and socially through interaction with their environment (Ibid.). According to Zarei (2008), four main characteristics can be specified for the social constructivist approach: firstly, learners construct their own learning; secondly, learners' new learning depends on their existing knowledge; thirdly, social interaction plays a critical role in learning; and finally, meaningful learning depends on authentic learning tasks.

Reading according to the social constructivist approach is a social practice. That is to say, what, when, where, how, why readers read and with whom they read are all affected by their social context (Yang & Wilson 2006). From the social constructivist's perspective, it is therefore important to take into account the readers' background, culture and previous reading experience throughout the reading process. These factors shape a reader's current reading practices, performance and

development. Other constructivist scholars also agree that individuals make meaning through communication, collaboration, social negotiation and interaction with each other and with the environment in which they live (Prawat & Floden 1994). Therefore, it is also essential to consider reader's current social interaction and communication to understand the factors that contribute towards constructing readers' reading practices.

Having discussed how readers' sociocultural activity and experience affect their reading process, the following section addresses another element of the sociocultural theory that is relevant to the current study, that is, the zone of proximal development and scaffolding in on-screen second language reading.

### **2.6.5 Scaffolding and the zone of proximal development (ZPD)**

Other fundamental concepts of Vygotsky's sociocultural perspective are scaffolding, and the zone of proximal development (ZPD) (Pritchard & Woollard 2010; Tracey & Morrow 2012; Yang & Wilson 2006). In Vygotsky's sociocultural theory, language is learned through mediated activities, such as interactions between people (Sutherland 1992). Vygotsky stated that the mental functions of an individual are performed in collaboration with other people before being independent (Ibid.). In other words, the learner can achieve potential development in a target language through interpersonal interaction with experts or with more advanced learners (Saville-Troike 2012). Vygotsky called that distance between the learners' current knowledge and the level they can achieve through the help of others the zone of proximal development (ZPD) or assisted learning. Thus, a person can produce with assistance what they cannot produce alone. Scaffolding makes it possible for learners to co-construct their knowledge via shared activities (Hedegaard 1996). Scaffolding is the support provided by others; for example, parents, peers, teachers or reference sources, such as dictionaries that enhance students' performance (Cheyne & Tarulli 2005). This support is dynamic and temporary; and is gradually reduced as the learner becomes more and more effectively involved in the task, until they reach the independent learning stage (Ibid.).

This traditional view of scaffolding focuses on the social dimensions of interaction and dialogue with other people as a source of assistance, highlighting how a more knowledgeable person can help and support the learning of others (Hedegaard 1996; Corrigan et al. 2005; Cotterall & Cohen 2003; Gibbons 2003; Swain et al. 2002; Tuan & Nhu 2010; Watanabe & Swain 2007). However, recent literature has expanded the theory to include technology. Bull et al. (1999) differentiated between two types of scaffolding through technology; computer-based support and teacher or peer support.

Computer or technology scaffolding includes tools, strategies, and guides that enhance learners' independent learning (Teo 2012). For example, Ohta (1990, cited in Ohta 2006) reported that the zone of proximal development can be not only via interaction with people, but also via interaction with other resources, such as books, dictionaries and written captions on a screen. Thus, scaffolding now includes a new form of supportive learning, namely technology. This new dimension of scaffolding focuses on the assistance that learners receive from technology and electronic media.

During the past two decades, several researchers have highlighted the benefits of scaffolding provided through technological guidance and its effective assistance in the learning process (see Chen et al. 2008; Jackson et al. 1998; Lajoie 2005; Lim et al. 2011; Lin & Overbaugh 2011; Montelongo & Herter 2010; Puntambekar & Hubscher 2005; Quintana et al. 2004; Quintana et al. 2005; Yelland & Masters 2007; Ohta 2006; Wood & Wood 1996; Brush & Saye 2002; Bull et al. 1999; Englert et al. 2004). Technology makes it possible for learners to accomplish tasks which otherwise would be beyond their capabilities. Technology enhanced environments provide resources and tools which are traditionally provided by tutors, experts or more knowledgeable peers (Sharma & Hannafin 2007).

A review of this literature reveals that technology scaffolding enables learners to reach a stage where they can accomplish activities independently. For example, Ohta (2006) stated that adult learners can create and manage their ZPD via interaction with different media, such as watching the news to improve their speaking skills. Wood and Wood (1996) reported that computer software programmes can act as scaffolding that guides learners toward a particular outcome. Brush and Saye (2002) illustrated that expanded scaffolding is provided by technology aids that offer several means of exploring ideas and special representation. Bull et al. (1999) suggested that scaffolding could be presented in links to web pages, downloadable help pages and online communication.

In the reading domain, researchers have situated electronic text assistance within the Vygotskian concept of scaffolding. Several reading researchers assert that electronic text supports and enables readers to read and comprehend text that might otherwise be incomprehensible (Anderson-Inman 2009; Cummins et al. 2008). Several research studies have proved that scaffolded electronic environments can support second and foreign language readers by providing effective tools for reading comprehension and vocabulary expansion which hard copy environments lack (see 2.5.5 for further detail about how technology scaffolds reading).

## 2.7 Research questions

The previously presented literature review provides the substructure for this research. Several aspects are drawn from this to construct the theoretical framework. These are:

1. On-screen reading is part of digital literacy and includes DASL (see 2.3.1).
2. Proficient L2 reading seems to comprise both reading processes: top-down and bottom-up (see 2.4.4 & 2.6.1).
3. Readers need different types of reading strategies in order to read and comprehend academic text (see 2.5.1, 2.4.2 & 2.4.3).
4. Readers employ reading strategies during on-screen reading based on their applicable print based reading strategies (see 2.5.1).
5. All sorts of schemata, namely formal, content and digital, are necessary to enable reading comprehension (see 2.6.3).
6. Reading is not solely an individual practice; it is both an individual and a social practice (see 2.6.4).
7. On-screen reading including the use of digital affordances and the electronic version of the Vygotskian concept of scaffolding, insure better engage with text and consequently achieve better comprehension than print-based reading (see 2.5.5 & 2.6.5).

The following research questions were therefore formulated to examine the nature of on-screen reading comprehension (in particular the cognitive reading strategies), to contribute to the discussed digital academic strategy literacy (DASL) (presented in 2.3.1) and to scrutinise the similarities and differences of on-screen reading with print-based reading comprehension (see 1.4 for aims of the study).

### Research question one (RQ1)

1. What is the nature of the on-screen L2 academic cognitive reading strategies used by postgraduate students in the UK educational context when reading research articles in their field of study?
  - a. What types of on-screen functional reading strategies do L2 readers use, and with what frequency?
  - b. What types of on-screen sub-strategies do L2 readers use, and with what frequency?

- c. What is the nature of on-screen reading processes in terms of bottom-up and top-down approaches?
- d. Do L2 readers use different sub-strategies to deal with different parts of on-screen text, and, if so, what are they?
- e. What types of technological benefits (digital affordances) do L2 readers take advantage of when reading on-screen, and with what frequency?
- f. What is the nature of the academic on-screen reading challenges faced by postgraduate L2 readers of English in the UK educational context when reading a research article on-screen in their field of study?

### **Research Question two (RQ2)**

- 2. What are the similarities/dissimilarities between on-screen reading and print-based reading?
  - a. What are the similarities/dissimilarities in strategy type and use (frequency) when reading on-screen and print-based academic text?
  - b. What are the similarities/dissimilarities of reading comprehension challenges between on-screen and print-based academic reading?
  - c. What are the similarities/dissimilarities of reading components between on-screen and print-based academic reading?

The next chapter illustrates the route followed to answer these research questions. It presents the research design of the study, the methods used to collect the data, the data collection procedure and the analysis methods used to obtain the results.

## Chapter 3: **Research methods for collecting evidence and crafting analysis**

### **3.1 Introduction**

The preceding chapter provided the framework for the themes and central questions of this study. The findings of the previous research on digital literacy, traditional reading, L2 academic reading, and on-screen reading have been identified. This chapter presents the research design including the methodology chosen for this study and a justification of the research design. A discussion of the qualitative approach and its contribution to this study is presented in 3.2. The chapter then (3.3 & 3.3.1) describes the case study approach selected for this study and explores the advantages, disadvantages and appropriateness of this approach in terms of meeting the objectives of this study. Fifteen postgraduate PhD and five Saudi female Master's students participated in the study that took place in the UK. The selection process used to identify these participants is discussed in 3.4. Research trustworthiness is discussed in 3.5 followed by a discussion of the triangulation in the methods in 3.6.

Under 3.7, a description has been given of the methods chosen to collect the data, including the demographic questionnaire, the think-aloud protocol, field notes, stimulated recall and interviews, together with the reasons for choosing these particular methodologies. The reading materials used in this study, which were chosen by the participants themselves, are discussed and justified in 3.7.2.

Detailed information on the data collection procedure, including the pilot study, ethical considerations, the main study and the think-aloud training sessions, are presented under 3.8. The chapter in 3.9 concludes with a description of the data analysis procedures, including information concerning the raw collected data, an analysis of the case studies and data analysis methods.

The qualitative approach was deemed to be the best method to employ for the purposes of this investigation. Before defining, describing and providing justification, an explanation of the research design is provided in the following section.

### **3.2 Research paradigm: Philosophical orientations**

A research paradigm is a way to understand reality, collecting information about the world and building knowledge (Tracy 2013). It is based on three elements; ontology, epistemology and methodology that are crucial for refining, identifying and clarifying the research design to be employed in a study. Ontology refers to a view of how to understand social reality and human behaviour. It can be illustrated by either one of the two perspectives; positivism and/or constructivism. Positivism is based on the belief that there is only one fixed and agreed reality. On the contrary, constructivism maintains that there is not a universal truth, while meaning and knowledge are socially and contextually constructed by individuals through interacting with the world around them (Croker 2009). Epistemology is the nature of knowledge that is intended to be collected and the formulation of research questions. Methodology refers to the strategies and the methods selected to collect specific data about specific phenomena (Cohen, Manion & Morrison 2011). Based on (Lincoln & Denzin 2003; Locke et al. 2010; Tracy 2013; Croker 2009; Cohen et al. 2011) the research paradigm in this study has been formulated (see Figure 3, p.89) to address a gap in the knowledge about on-screen reading, digital academic strategy literacy and the problem of readers' lack of sufficient DASL (mentioned in 2.3.1) when interacting with text on-screen. This is related to the lack of research in the field.

(Continued overleaf)

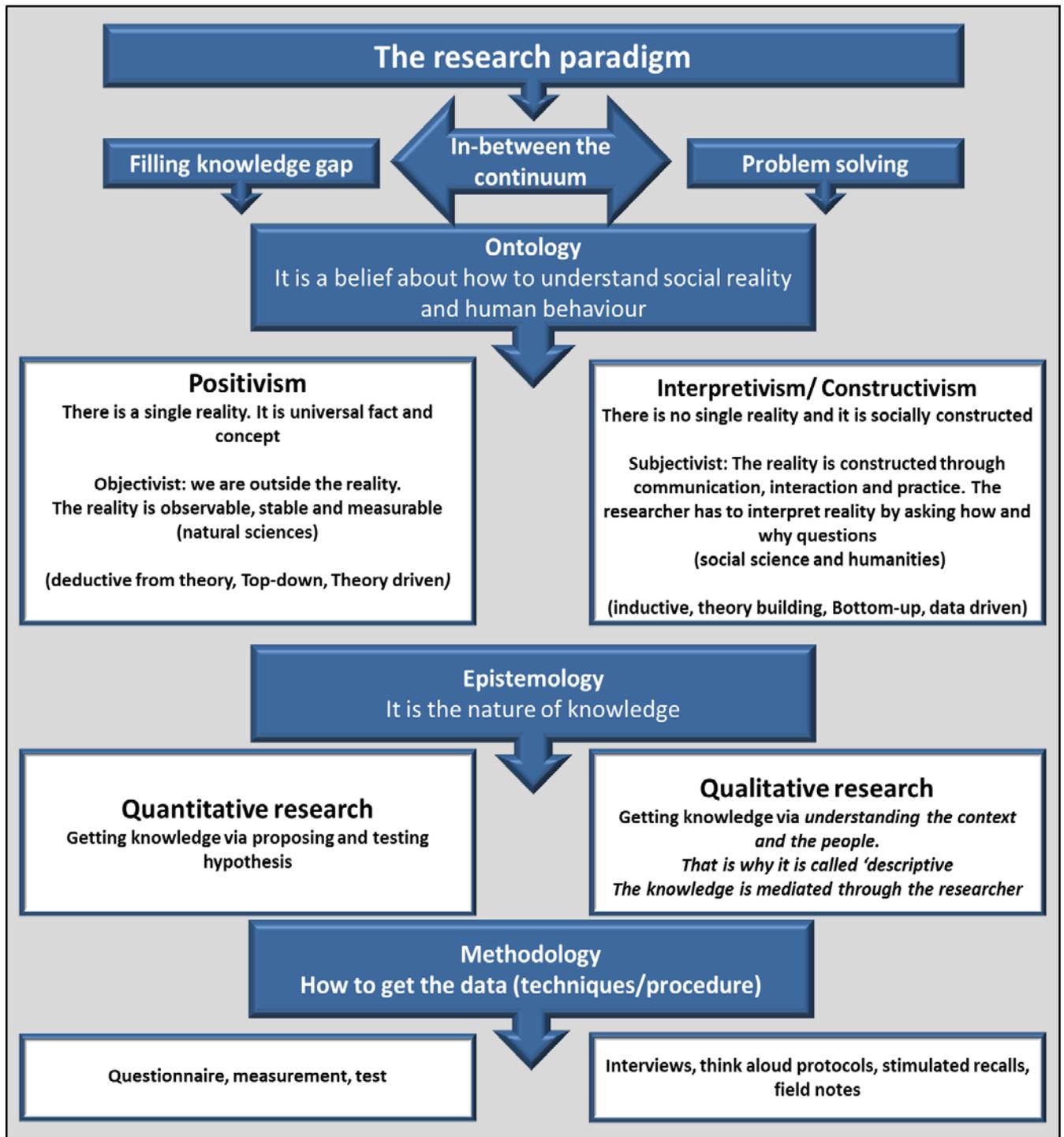


Figure 3: The research paradigm for this study – It is based on (Lincoln & Denzin 2003; Locke et al. 2010; Tracy 2013; Croker 2009; Cohen et al. 2011)

The design in Figure 3 has been formulated to frame the present research. It is based on three concepts, namely ontology, epistemology and methodology. These three elements of the present research paradigm are described below.

## **1. Ontology**

To achieve present research objectives, interpretative ontological philosophy, which is based on constructivism, was adopted, as it is argued that there is no single reality, but that reality is constructed, shaped and constantly modified according to the context. In this study, the educational context in a specific area (the UK) and during a specific period of time (the 21<sup>st</sup> century) has an influence on reading practices. Thus, what it is considered to be reality in a specific context and period of time could not have occurred at other periods during the past and/or the future.

The current study has adopted the interpretive qualitative approach as the aim of this research is not to simply judge individuals or a particular setting, but to contribute to existing knowledge and to generate additional theories in reading research. Consequently, this approach makes it possible to understand specific phenomenon and the meaning that they hold for the participants. The qualitative interpretive approach facilitates exploration of the research participants' L2 digital academic reading practices and perceptions from various angles. This makes it possible to interview, observe and record the subjects' L2 academic digital reading, analyse their actual reading practices as expressed in their own words, and to scrutinise the challenges that they face when reading in a specific context. According to Locke et al. (2010) interpretive qualitative research uses a variety of methods to collect, integrate and present a variety of data: observation of the situation or events under investigation; field notes; interviews; and examination, and analysis of documents and materials such as lesson plans, reports, and diaries. It can also include an analysis of individuals' own words or texts to describe routines or problematic moments in their lives (Lincoln & Denzin 2003).

## **2. Epistemology**

In the current study, qualitative interpretive research assists the researcher to answer questions related to the kind of strategies postgraduate students utilise when reading L2 digital academic texts, postgraduate students' L2 digital academic reading experiences in the UK context, their L2 digital academic reading challenges, and the changes that occurred over time in their reading practices.

The researcher used an interpretive qualitative approach in the current study to closely observe, explore and describe in detail the actual L2 digital academic reading comprehension of postgraduate students in their natural environment. According to Friedman (2012); and Lincoln and Denzin (2003), qualitative research occurs within natural settings. Utilising the qualitative approach provides the opportunity to observe and identify how the subjects' L2 academic reading practices have changed over time in the UK educational context. The qualitative approach also makes it possible to explore

the contextual and individual factors that may have an effect on the subjects' reading practices. According to Dörnyei (2007), a qualitative approach provides a complete, rich and detailed insight into specific practices, responds to the changes that occur in practices and acknowledges the diversity of experiences via observations, interviews and/or research notes (Bogdan & Biklen 2011). It also explores the factors that contribute to the construction of the subjects' L2 digital academic reading practices in the UK context. According to Merriam (2009), qualitative research reveals the ways in which people construct specific practice. Qualitative research based on the interpretive paradigm also allows the researcher to reveal the subjects' perspectives on and perceptions of the changes that occurred to their L2 academic reading comprehension, the factors that contribute to these changes, and their perceptions of their academic reading experience in the UK context.

Qualitative data is collected to answer research questions that depend on reflection and insight, instead of assessing performance using tests or quantitative methods (Laban et al. 2012), and focuses on the subjective perspectives of the participants (Bogdan & Biklen 2011), the manner in which they relate to their surroundings and make sense of their experiences (Berg 2004). It focuses on the perspective of the participants rather than on that of the researcher (Bogdan & Biklen 2011; Yin 2011) and presents the participants' voice (Tracy 2013). Thus, employing a qualitative approach in the current study makes it possible to comprehend fully a specific scene from the subjects' point of view by observing their actual reading practices and interviewing them.

### **3. Methodology**

In the current study, the researcher interacts directly with the research participants, collecting data mainly face-to-face, via observations and interviews. As the main goal of this qualitative research is to understand students' actual reading practices and attain meaning, the method is ideal for collecting and analysing the data. Being a direct agent, in the current study, the researcher can effectively expand the scope of the study by recording verbal and nonverbal practices, and checking the accuracy of any responses with the participants themselves (see 3.7.4 for audio-visual documentation). According to Merriam (2009), in a qualitative approach, the researcher is the primary instrument of data collection and analysis and the direct agent as s/he interviews, observes, or/and takes notes in a natural setting.

Another important feature of the qualitative approach that justifies this choice is its inductive feature (bottom-up) (Bogdan & Biklen 2011; Merriam 2009; Friedman 2012; Tracy 2013). Information is gathered from participants in a specific field in order to reach a logical conclusion

(Friedman 2012). As this takes place in the field, observation, interviews or/and documents can be combined, ordered and analysed to generate, construct new knowledge and theory (Merriam 2009) or develop new concepts (Yin 2011). Based on this, the qualitative approach in the current study facilitates data collection by observing the actual L2 academic reading practices of the students and interviewing them about specific behaviours. It allows specific elements of the students' digital academic reading to be examined, their actual L2 academic reading practices to be conceptualised and any patterns that exist across the observed individuals to be established. It allows for the development of new concepts and improved understanding, general statements and hypotheses (or even theories) to be formed about a particular aspect of the participants' L2 academic digital reading, instead of simply testing and proving or disproving existing ones.

The qualitative approach is a research methodology that enables researchers to understand how people interpret their experiences and construct knowledge and the meaning that they attribute to their experience. According to Cohen, Manion and Morrison (2011) the qualitative approach is a 'group of designs that elicit verbal, aural, observational, tactile, gustatory, and olfactory information from a range of sources including, amongst others, audio, film, documents, and pictures, and that it draws strongly on direct experience and meanings' (p.219).

Despite the advantages of qualitative research for the current study, some critics have argued that, when a sample population is limited, its results are difficult to transfer to other groups in other situations. However, this is countered by those qualitative researchers who state that they are unconcerned with the question of generalisation, as their role is to document a specific setting or group of subjects, rather than to position them in a wider context (Bogdan & Biklen 2011). Also, the researcher believes that the first step towards ensuring that the results of a study can be generalised is to obtain in-depth data from a specific group of participants using qualitative methods and then to group the results in a questionnaire which is then administered to a large group of people from the same category.

A further drawback of the qualitative approach to consider is that it can be time consuming and requires considerable skill and effort on the part of the researcher. For example, the researcher in the current study needs to be in the field of study (see 3.8.3 for further details about the main study procedure), spend time observing subjects while reading, and/or preparing interview questions. However, the researcher believes that given sufficient time and skill, this can result in in-depth and accurate data. That is, spending time observing the actual reading practices of students' and being skilful enough to question them about specific behaviours that occur during their reading would reveal in-depth and generate new findings. Moreover, allocating enough time to arrange accurate

semi-structured interview questions and spend time skilfully interviewing the participants about specific behaviours in their L2 academic digital reading practices could result in unanticipated responses that may reveal new information or offer an innovative contribution to second language digital reading research.

Other criticisms focus on the potential bias in qualitative approaches, as the methods used allow researcher's opinions and prejudices to influence the results (Bogdan & Biklen 2011). However, subjectivity is considered a component of many different kinds of research, including experimental studies and questionnaires, the construction of which is unavoidably influenced by the bias of the researcher. Bias resulted from interference from the researcher's opinions and expectations; however this was managed by striving to guarantee subjectivity by recording detailed field notes, video and audio recording data, and having data critiqued by two colleagues throughout the data analysis procedures. By adopting these techniques, the benefits of the qualitative approach can be maximised and its drawbacks minimised.

Qualitative research can be carried out by adopting a wide variety of methods according to the research objectives and questions proposed, namely:

1. Biography (which aims to explore individuals' lives)
2. Phenomenology (which focuses on developing theory in specific fields)
3. Ethnography (which describes cultural and social groups)
4. Grounded theory (which is based on the production and development of new theory), (Locke et al. 2010)
5. Action research (which emphasises the researcher's adoption of specific action with study participants in order to improve specific practice (Yin 2011))
6. Case study (which includes in-depth investigation and analysis and provides descriptive data of the subject being studied)

For the present study, a case study approach has been selected. The following section explores this approach in further detail, provides definitions, advantages and disadvantages and types; and discusses its appropriateness for the present study's objectives as presented in 1.4.

### 3.3 Case study approach

The case study approach emphasises a detailed contextual analysis of a limited number of individuals and events, in a small geographical area, that is sufficient to show the effect of a variable on subjects' conditions and behaviours (Yin 2011 & Zainal 2007). It can be applied to address complex issues or objectives, and can extend experience or add strength to what has previously been established (Cohen et al. 2011 & Yin 2009). Case study researchers examine data closely in their specific context by engaging in methods involving direct observation and interviews with the participants (Zainal 2007 & Cohen et al. 2011).

Previous literature demonstrates the application of the case study method to reading research and its essential role in forming an effective picture of L2 readers' reading practices in general and reading strategies in particular (Bang & Zhao 2007; Chen 2009; Zhang & Duke 2008; Park & Kim 2011; Alsheikh 2011; Seitz 2010). These case studies have influenced researchers' views of reading practices and improved the most complex teaching and learning reading processes. They have demonstrated the effectiveness of the case study as a research methodology when examining the reading process and its development, by providing material for in-depth analysis concerning specific contexts. For example, Park and Kim's (2011) case study revealed that college level students apply traditional paper reading strategies to read digital text. Bang and Zhao (2007) found that teachers should provide Korean and Chinese ESL students with a set of commonly used morphemes, while training them to recognise their meanings within words, in order to increase students' ability to comprehend texts.

A case study approach was chosen for the current study for several reasons. First, because it makes it possible to closely observe and collect in-depth and detailed data pertaining to a particular group (postgraduate students), to explore the ways in which they read digitally in a specific context (the UK) and their perceptions of L2 digital academic reading. According to Lier (2011), the case study spotlights a specific group in a specific context. Thus, it relates the reading practices of the subjects to their current educational context, to offer an understanding of its influence on behaviour and processes. The case study approach therefore involves interrogating data within its actual context (Cohen et al. 2011); this makes it possible to scrutinise the actual reading practices of readers in the UK educational sector. Cohen et al. (2011) asserted that the case study consists of data emerging from detailed and specific investigations collected over time (Hartley 2004). Thus, it is a key method for the current study that investigates, observes and documents changes in students' L2 academic digital reading. In addition, it provides the opportunity to explore participants' perceptions of their reading practices; the changes that have occurred, the factors that have affected their reading

practices, and their perceptions of those factors. Johnson (1991) stated that a 'Case study can provide rich information about an individual learner. It can inform us about the processes and strategies that individual L2 [second language] learners use to communicate and learn, how their personalities, attitude, and goals interact with the learning environment, and about the precise nature of their linguistic growth' (p.76).

Using a case study design also makes it possible to gather unique or unexpected data that is unavailable when using larger scale methods, such as questionnaires. In the current reading research, a case study can reveal the types and numbers of the L2 digital academic reading strategies used alongside the reasons for their use, the relationship between them, and the changes that occur during their use and their causes. Case studies are also effective for scrutinising subjects' utilisation of digital technology during their L2 academic reading. Furthermore, it enables the researcher to collect data concerning barriers to readers' L2 academic digital reading, and explains how they overcome them, to analyse the contributory factors that are changing students' L2 reading practices, and offers details of source preferences and performance within the UK educational system. Therefore, adopting a case study approach in the current study is both appropriate and effective.

Despite the advantages of case study research, there have been criticisms of its procedures, results, and findings. First, this is because case studies can lack consistency both procedurally and in terms of results (Yin 2009). However, the likelihood of inconsistent procedure and results is low in the current study, as the research design has centred on the specific purpose of the study and the methods that are applicable to achieve the research objectives. Second, the findings and conclusions can be affected by researcher's bias (Yin 2011 & Cohen et al. 2011). However, peer review of the data is included in the present research design to avoid this.

Third, the data provides little basis for scientific generalisation due to the limited number of subjects or cases within a single specific context (Yin 2011), and so the results may not be applicable to different contexts (Cohen et al. 2011). Generalisation is a complex matter affecting case study research. However, as the participants in the present study come from one educational context (Saudi Arabia) and are all now studying within the same educational context (the UK) as postgraduate students and can be assumed to share similar characteristics, the results can be generalised to other students with similar characteristics. Cohen et al. (2007) stated that generalisation can proceed 'from features of the single case to a multiplicity of classes with the same features' (p.254).

Fourth, case study research can be difficult to conduct as it demands time and effort on the part of the researcher and the process of generating a large volume of data can be difficult to manage. However, expending time and effort on the current study has generated results that facilitated the drawing of conclusions and assessment of the implications of the case study (see 7.3) Moreover, the depth of the data gathered represented the reading practices genuinely employed by the research participants. Furthermore, NVIVO software program has been used to facilitate data organization (see 3.9.6 for using qualitative data analysis software).

Finally, a case study requires extensive cooperation from the research subjects, as insufficient cooperation can reduce the validity of the data. To ensure high levels of cooperation for the current study, good relationships were established with the participants. This involved contacting them regularly and asking about their health, life and studies.

In order to accomplish different goals using case study research, researchers have classified the case study into different approaches according to specific research questions. These are now discussed in relation to the present study.

### **3.3.1 Types of case study**

The literature presents different classifications for case studies. According to Yin (2009), the most suitable case study method can be influenced by the type of research questions asked. Merriam (1998) for example, notes three types of case studies: descriptive, interpretive, and evaluative. Yin (2009, 2011) classified further categories of case study in accordance with Merriam's classification. He defines four types of case study, namely exploratory, descriptive, explanatory and evaluative.

1. Exploratory case studies aim to explore a point of interest to the researcher, i.e. in a research study about reading, the researcher may ask questions such as: 'Does a student use any strategies when he reads a text?' and 'if so, how often?' (Zainal 2007, p.3). The current study is exploratory as its principal objective is to explore the L2 digital academic reading practices of postgraduate students in the UK educational system and to identify the nature of any changes to these practices as they occur over time, as well as the main factors that influence L2 academic reading practices. Three procedures have been applied to achieve these goals; direct observations, stimulated recalls and interviews.
2. Descriptive case studies share similar features and overlap with exploratory ones. They are concerned with describing specific conditions, situations or problems within a context. The researcher describes and illustrates events as they occur; i.e. asking what kind of strategies the reader utilises in specific contexts. This requires the researcher to begin with a theory to

support the description of the phenomenon under examination. The current study is descriptive, as this is a necessary requirement to clarify the digital L2 academic reading strategies utilised by the postgraduate students. Description is also necessary to explain their use of digital technology when reading L2 research articles in their field of study, as deductively categorised based on the cognitive and the socio cultural theories mentioned in chapter two and the reading strategy scheme mentioned in 3.9.2, Table 2, p.125.

3. Explanatory case studies generate explanations for specific occurrences. Answers are sought for the questions 'how?' And 'why?'. There is also an attempt to clarify relationships and investigate causality between several variables, i.e. the researcher may ask questions, such as 'why did the reader use translation or predictive strategies when reading for pleasure?' The current study also has explanatory elements as its aim is to explain why respondents rely on one specific reading strategy rather than on another, and why they prefer (or not) to read digitally. Investigating causality in the present research and studying the cause and effect of subjects' current L2 academic digital reading comprehension in the UK educational sector have been completed in light of cognitive and sociocultural theory via stimulated recall sessions and interviews.
4. An evaluative case study requires the researcher to explain and then add his/her judgement and reflections to the results (Cohen et al. 2011). The current study is evaluative as it aims to evaluate the digital strategy literacy status of a particular group of international students.

Stake (1995) added two other types of case study: intrinsic and collective. The first type, intrinsic case studies, are often exploratory and concerned with investigating and understanding specific individuals, groups, departments and organisations, for the researcher's own purposes. The aim of an intrinsic case study is to understand the uniqueness of the case rather than to build a theory or seek generalisations. Collective case studies involve groups of different cases that are investigated in order to draw a fuller picture. The current study is an intrinsic/collective case study, according to the above classification, as it attempts to acquire a better understanding of the uniqueness of a particular group, L2 postgraduate students within the UK education sector, and also includes two groups of individuals, Master's and PhD students.

Taken together, the current study is an exploratory, descriptive, explanatory, intrinsic, collective/multi, and evaluative case study. The following section discusses the research participants in the current case study.

### 3.4 Research participants and context

The study population for this research consisted of postgraduate Saudi female students studying at the University of Southampton in the UK. This included five female Master's students studying different subjects: two from Health Science, one from Psychology, one from Education and one from Accounting. The other group of participants consisted of fifteen female PhD students majoring in different subjects: Accounting and Finance, Management, Design, Engineering, Psychology, Computer Science and Health Science. The research subjects were selected based on a non-random method (purposive sampling) in order to obtain the richest and most detailed information to answer the research questions (Appendix A provides further details of the research participants' demographic profiles). They were selected based on a degree of homogeneity; all share the following characteristics:

1. They are Saudi
2. They are female
3. They are native speakers of Arabic
4. They study in the UK
5. They learnt English as a foreign language in their home country
6. They took their Bachelor's degree in Saudi Arabia
7. They took a language course (at least three months) before commencing their postgraduate degree
8. They are postgraduate students
9. Their English language proficiency as estimated from their IELTS exam scores is upper-intermediate (i.e. 6.5)

Several points were considered when selecting the study participants. Knowledge of the Saudi Arabian student context was the first factor that motivated the researcher to recruit Saudi students for the present study and to investigate and track Saudi students studying in a similar context to the researcher. The other factor was L2 (English) reading education in Saudi Arabia. According to Alsamadani (2009) and based on his own personal experience, teaching English reading skills in Saudi classrooms focuses mainly on repeated reading, introducing new vocabulary, and structure. The teacher's main focus in the reading class is to encourage students to read different kinds of texts presented in their textbook repeatedly. Usually, the teacher models reading by reading the text aloud for the students or occasionally the teacher uses a tape recorder for the same purpose. Then, the students read the text individually. After that, the teacher requires the students to answer comprehension questions located at the end of the passage. The teacher occasionally writes guided

questions on the board and requires the students to read the text silently and to attempt to find answers to the questions. All the answers can be accessed directly in the reading text and the questions are not critical or analytical. The teacher then measures the students' reading comprehension by asking the students to answer comprehension questions. Little help is given to the students to assist them with becoming efficient L2 readers and there is no effective training in terms of the reading process and its cognitive and metacognitive strategies. English reading instruction in Saudi Arabia is based on understanding vocabulary, citing answers from a text and oral skills, while learning how to read, using strategies to comprehend, reflect, analyse and evaluate are all neglected. Moreover, lessons in the skill of L2 reading are based on reading from hard copies or printed materials, and no attention is paid to digital reading.

This study only investigates Saudi students who are studying in the UK context as this is the context in which the researcher had a number of years of experience and could thus understand the demands of the UK educational context and the tutors' expectations of the students to succeed in a Master's or PhD programme.

Focusing in-depth on a smaller group provides a better picture than studying a larger group of readers. This guided the decision to investigate fifteen PhD students and only five Master's students. The five Master's students were judged to be suitable because the study was going to be a longitudinal case study, requiring the thorough investigation of students' reading practices at three points throughout their Master's year programme. However, due to practical difficulties, the researcher could not meet the five Master's readers for the third time after they had submitted their Master's dissertations.

Postgraduate students were the logical focus of this study because their studies require them to read extensively and intensively in order to be able to meet their postgraduate course requirements effectively. They are also required to read more from digital resources and engage more deeply with digital reading than undergraduate students because of their specified research purposes. Most postgraduate students are also more committed to their studies than undergraduates, as they are eager to become specialised in their chosen specific fields, making them a more relevant study group than undergraduates. In addition, postgraduate students have the necessary linguistic knowledge that enables them to, at the very least, read and comprehend simplified L2 digital academic documents. In addition, this is a relatively under researched group when compared to L2 reading research involving children and undergraduates. Furthermore, insights into the reading processes of postgraduate students might suggest potentially beneficial pedagogical interventions to bolster L2

language learners, L2 undergraduate students and those students who intend to complete postgraduate degrees. Both Master's and PhD students were included to emphasise the nature of the reading practices of all postgraduate students; and for comparison.

Recruiting only female participants eliminated the effects of gender in the present study. The study also focused upon female participants as in the Saudi educational system women are separated from men; as a group, women are educated together and have similar reading practices. The other factor that motivated this research was the rapid development of women's higher education in Saudi Arabia in recent years. In 1962, the first girls' college was established in the capital city of Saudi Arabia and approximately ten colleges had opened by the 1980s to prepare female teachers. The first university to establish a women's campus was Riyadh's King Saud University (in 1979). This was followed by the Jeddah campus at King Abdul-Aziz University, Dammam City campus at King Faisal University and Umm Al-Qura University campus in Makkah. Since then, women's education has developed and further public and private universities and a number of colleges have been established. In 2008, Princess Noura Bint Abdul Rahman University was opened in Riyadh to cater for 40,000 female students (Alhareth et al. 2013). The university was designed to be one of the largest universities in Saudi Arabia for women. Various subjects were made available for study, such as education, general science, computer sciences, and subjects such as Arabic, English, Biology, Mathematics, Religion, Geography, History, Psychology, Art, Agriculture, Nutrition, E-business, and Health-care. Saudi women have also been permitted to study medicine, nursing, dentistry and pharmacy (Hamdan 2005). The pedagogical implications of the current study (presented in 7.3) will be applicable to all international students both male and female; but particularly those at female institutions in Saudi Arabia.

Finally, the decision was made to select participants from different subject areas because several bodies of reading research found variations in the reading strategies that students' utilised according to the disciplines in which they studied. Thus, this study will help to investigate the reading practices of students according to their different disciplines, and to scrutinise the effect of these disciplines as an additional factor influencing digital academic reading practices in general and L2 digital academic reading strategies in particular.

Before presenting the research instruments, it is necessary to detail the importance of trustworthiness, as well as the triangulation applied in the current study.

### 3.5 Research trustworthiness

Validity and reliability are essential issues that ought to be considered in any research. However, due to the naturalistic nature of the qualitative approach, which aims to understand phenomena in a specific context, several researchers have demonstrated that the terms validity and reliability may not apply to qualitative research (Bashir et al. 2008). According to Golafshani (2003), qualitative researchers 'strongly consider these concepts defined in quantitative terms as inadequate' (p.599). Thus, several researchers have readdressed these concepts and set criteria for qualitative research. For example, Rolfe (2006); Whittemore, Chase and Mandle (2001) proposed the terms quality and rigor. Others suggested credibility, transferability, dependability, confirmability (Daymon & Holloway 2010; Thomas & Magilvy 2011) and consistency (Lewis & Ritchie 2003). However, in qualitative research, the term credibility is often preferred over validity, and the term transferability is used to present reliability (Bashir et al. 2008). These two terms according to Lincoln and Guda (1985, cited in Daymon & Holloway 2010; Major & Savin-Baden 2012), are consequently widely used to assess the trustworthiness of qualitative research.

In the present study, credibility, which depends on rigorous data collection and the precision of findings (Daymon & Holloway 2010; Major & Savin-Baden 2012), was maintained through the triangulation of data resource collection and member checking (see 3.6 for further details). The main concern in the current qualitative study is the attainment of an accurate understanding of the collected data. Credibility therefore lies in matching recorded data with the experience of the participants in the context under investigation. In this way, different studies in the same setting or subject may result in different data, although both remain credible (Bogdan & Biklen 2011).

Transferability centres on the applicability of transferring research findings from one group to another (Major & Savin-Baden 2012; Thomas & Magilvy 2011) and is achieved by providing a dense description of the demographics of the subjects studied, the context of the research and the research design. In terms of this study, the reader can evaluate and determine if the findings are applicable to her/his own experience and/or to another group in another setting. According to Lincoln and Guda (1985, cited in Saini & Shlonsky 2012) readers need to be 'fully informed about the process, context, and situations of the qualitative synthesis in order to make judicious decisions about the transferability of findings' (p.66).

### 3.6 Triangulation

The meaning of triangulation is demonstrated by Cohen et al. (2011) who stated that it is the 'use of two or more methods of data collection in the study of some aspect of human behaviour' (p195). Various kinds of data were triangulated in the current study; readers' reading strategies and challenges whilst reading were scrutinised via think-aloud sessions, stimulated recalls, the reading strategies scheme and field notes. The use of digital affordances, reading challenges and ways of overcoming reading challenges were also scrutinised via the previously mentioned methods in addition to the semi-structured interview questions. Participants' perceptions of reading digital English academic text were scrutinised via the semi-interview questions.

The triangulation of data eliciting methods serves the current study in several significant ways:

1. It provides a clear understanding of the problem under investigation (Thurmond 2001), an-in depth understanding of the phenomenon in question (Lincoln & Denzin 2003) and precision with regard to the research findings (Lewis & Ritchie 2003). The current study also attempts to reach a clear and in depth understanding of the postgraduate students' L2 digital academic reading strategies, the challenges that they face, their ways of overcoming such challenges and the use of digital affordances whilst reading via the use of multiple methods. The interview and stimulated recalls were used following the think-aloud protocol, and field notes to enable deeper investigation.
2. Triangulation enhances the credibility of qualitative research (Lodico, Spaulding & Voegtle 2010; Tracy 2013 & Yin 2011). Thus, the triangular technique can be used with the methods mentioned above to investigate specific perspectives relating to the current study in order to reflect and represent the reality of the aspects under investigation, increase the robustness of the study and insure the trustworthiness of the findings.
3. The use of triangulation in the current study was extended to recording data via the use of a video camera, the Camtasia software programme and the researcher's field notes to record and document the observed digital reading strategies, challenges and the use of digital affordances when reading. In this way, triangulation for the current study could reveal unique and unanticipated findings.
4. Triangulation in the data analysis minimises study bias (Cohen et al. 2011). To achieve this, two volunteer colleagues were recruited occasionally as consultants to check the accuracy of the data transcriptions, translations and the coding during the data analysis. According to Merriam (2009), peer debriefing enhances the credibility of qualitative research.

## **3.7 Research methods**

This study involves in-depth investigation; achieved by gathering data from a number of different sources (see 3.6 for triangulation) and therefore a combination of case study methods have been employed. According to Hartley (2004), a case study researcher uses a combination of methods to investigate complex phenomena in specific contexts. The current study adopts research techniques that are specified for second language reading research.

### **3.7.1 Research techniques in second language reading research**

The most commonly utilised techniques in second language reading research have been classified into two main techniques (Alderson et al. 2014 & Stevenson 2010):

1. Product-oriented techniques
2. Process-oriented techniques

Product-oriented techniques measure reading comprehension and provide information on the product (results) of reading. These offer insights into a reader's level of knowledge concerning a component relevant to reading, e.g. vocabulary or grammar, and consist of comprehension measures, recall measures, short responses measures, extended responses measures and knowledge component measures. On the other side, process-oriented techniques provide the researcher with information about the reading process and the actions of subjects while reading (Alderson 2000). These comprise verbal protocols, eye tracking, introspective protocols, and speed measurement (Ibid).

Two of the process-oriented techniques are connected and complement each other; i.e. verbal protocol and stimulated recalls. These were selected as the primary methods to accomplish the goals of the study, while the eye tracking method has not been chosen as it was not necessarily required for purposes of the present study. The third main method used was the data elicitation method, which comprises interviews conducted to reveal readers' attitudes toward digital reading, developmental progression in reading, previous reading practices in their home country, the effect on current reading practice within the UK context and the challenges that they experience during the academic reading process. In addition, the researcher's field notes and the demographic questionnaire were used specifically to achieve some of the aims set for the research. This chapter will continue to illustrate the methods used and give detailed reasons for adopting each of the

instruments mentioned below to collect the required data. The following section discusses the procedure used to select the texts used in the study and the rationale behind it.

### **3.7.2 Text selection**

Using a verbal protocol in reading research requires researchers to decide what type of texts will be read by the participants, according to the research goal (Pressley & Hilden 2011). For example, Brown et al. (1996) compared the reading strategies of students who had previously been given reading instructions with those who had not. Therefore, researchers ensured that all the participants read the same text. McCulloch (2013) chose to investigate (as naturalistically as possible) the way in which source materials were used by two Master's students while in the real situation of reading for their dissertations. Thus, the researcher ensured that the participants selected their own reading materials. Another study that adopted a naturalistic method for collecting data was conducted by Braten and Strømsø (2003). They used a think-aloud protocol in order to examine strategies spontaneously used by university Law students while attempting to understand multiple expository texts as part of their normal studies. Braten and Strømsø (2003) asked the participants to read self-selected texts at different points throughout one semester. The benefits of using self-selected materials rather than materials selected by the researcher are:

1. The task is a more authentic exercise, as the participants are reading the papers for their own studies, and this facilitates a more valid exploration of actual reading practices within their field of study.
2. As the purpose of this study is to investigate the reading challenges that students experience when they read research articles in their field of study, that the students are reading material for their own subjects is an essential component in generating accurate results.
3. This also enables the researcher to investigate the actual strategies utilised by students to overcome reading challenges in their academic fields.
4. It facilitates a real purpose and a real motivation to read, which will have a positive effect on the credibility of the research results.
5. This method of task selection provides the opportunity to discover something new, which is happening and which may be unexpected.
6. Participants' choice of materials and their familiarity with the text types in their field increases the validity of the findings. According to Cohen et al. (2011), a natural setting in qualitative data is one that maximises research validity and supports the researcher's belief of reality (see 3.2).

7. As some of the students are studying for a Master's programme over one year, their programme is very intensive. They may not wish to participate in the study, or read and re-read general articles twice (one printed and another digitally) during this time. Thus, self-selected reading texts are more motivating as the participants have a genuine self-directed purpose.

In the current study, the use of self-selected texts was adopted in the think-aloud protocols in order to gather data about the authentic reading experience of postgraduate students, their actual digital L2 academic reading strategies, the challenges that they face, ways to overcome such challenges and the use of digital affordances while reading research articles in their field of study. In order to avoid any consequences of repeat reading (which is not the focus of the current study), the participants chose unfamiliar research articles that they had not read before.

Each participant chose a printed article, and an electronic one covering the same topic based on instructions that were provided along with the invitation letter to harmonise the general aspects of the chosen reading articles between the participants (see Appendix B for text selection criteria). However, there is no attempt to harmonise the type of texts in terms of content and language complexity between the readers as the researcher in the present study aimed to achieve an authentic reading experience. Although the text itself is not the focus and it is not part of the present research to investigate the effect of different text types on students' academic reading comprehension strategies, an initial investigation of the text types that the students selected to read during the study reveals that they are generally similar in their use of the academic style and register, grammar and language, but differ in content. Adobe Acrobat was used as the reading application for digital reading, as according to Qayyum (2008), it is widely used for publishing web documents.

### **3.7.3 Think-aloud (TA) protocol**

Think-aloud (TA) protocol is one of the primary methods employed in the current study. It is verbal reporting of a qualitative data collection technique developed by Newell and Simon in 1972. TA can be defined as a method of observation in which the users are working with an interface and are encouraged to 'think-aloud', or to say whatever they are thinking at all the times during the process. It requires participants to inform the researcher of the cognitive process (such as their thinking, performing and feeling) while they are interacting with the written text (Ericksson & Simon 1993; Rheinberg et al. 2005).

Researchers have made a notable contribution to the understanding of first language reading strategies via utilizing think-aloud protocol (Farrington-Flint & Wood 2007; Hyönä & Nurminen 2006). This technique has also been used for data collection in second and foreign language reading research studies (Bowles & Leow 2005; AlKhaleefah 2010; Chun & Thompson 2008; Braten & Strømsø 2003; Lo 2011; Kendeou & Broek 2007). Reading research directed to study reading strategies has emphasised that verbal think-aloud protocols are a useful tool for gaining information about strategies used while reading L1 or L2 texts. For example: Abbott (2006), Nassaji (2006), Pressley and Afflerbach (1995) and Yang (2006) used TA to gain insight into the cognitive processes and strategies L2 learners use while reading. Other research studies use think-aloud to compare L1 and L2 reading strategies (Maeng 2005 & Yamashita 2002), and to examine the role of L1 in L2 reading comprehension (Seng & Hashim 2006). Moreover, think-aloud protocols contribute to an understanding of the relationship between reading and writing (Lo 2011).

Ericksson and Simon (1993) classified verbal reports into two types: retrospective and concurrent verbalisations. The retrospective type requires subjects to verbalise their thoughts after finishing the task (e.g. after reading a passage or part of it), while the concurrent type requires a simultaneous verbalisation of thoughts and performance (Yoshida 2008; Hartson & Pyla 2012; Pressley & Hilden 2011). Ericksson and Simon (1993) argued that verbal protocol should be concurrent, as this would reflect what is currently in the mind. This indicates that the researcher should ask participants to report on their thoughts while they are occurring. Ericksson and Simon (1993) stated that retrospective reporting is less accurate and complete than concurrent reporting.

Block (1986) similarly identified two types of verbal reports in order to obtain 'process oriented' data; these are retrospective and introspective reports, which are identical to retrospective and concurrent verbalisations. While Block's classification is similar to that of Ericsson and Simon's, Hayes and Flowers (1983, cited in Taylor & Dionne 2000) distinguished between two types of concurrent verbalisation; directed reports and interpretation of processes. In the latter, subjects are required to report on every thought that comes into their minds, while in the former; subjects are directed to report on specified behaviour while performing a task, such as explaining and justifying their use of specific strategies. Ericsson and Simon recommend that TA should only report the readers' thinking, rather than readers' interpretation of the process and strategies used (Bowles 2010).

Following Ericksson and Simon's (1993) point of view, the current study uses concurrent reporting, as it is most effective for an investigation of the actual reading strategies and processes that readers utilise while reading, and does not have the drawback of missing data that may occur in the

retrospective report. Contradicting Ericksson and Simon's (1993) view of the verbalised outcome, the participants in the current study were instructed in advance to verbalise all their thoughts, explain the reading difficulties that they faced, clarify their problem-solving methods and justify all their choices. In this way, maximum insight could be achieved, the data is enriched and a deeper understanding of reading comprehension is obtained without losing important details. It was decided that the best way to approach this investigation was to adopt the think-aloud method, for the following reasons:

1. According to Pressley and Hilden (2011), by implementing this method, important information about the subjects' reading strategies and strengths and weaknesses can be captured.
2. TA makes it possible to categorise readers into digitised or paper based readers according to observable reading strategies (Pressley & Afflerbach 1995).
3. This technique also enables exploration of the differences between the participants' print and digital L2 academic reading, in terms of the quantity and the quality of the subjects' utilised reading strategies, the employment of paper based reading strategies during digital reading and vice versa, and the use of digital affordances during reading.
4. TA procedure could also make it possible to indirectly access cognitive reading processes that could not be viewed using any other method. As Ericsson and Simon (1984, cited in Jaaskelainen 2010) stated TA provides indirect evidence concerning cognitive processes. It provides information about readers' current and actual thoughts, as presented in their short term memory (Pressley & Hilden 2011).
5. The TA attempts to provide a window onto the thinking processes of the participants, providing a clue to the challenges that they face during digital reading. This sort of benefit outweighs the use of other quantitative methods, such as a questionnaire, which may not show what the readers actually do when reading and only provide information about what readers think they do while reading.

In summary, TA was used in the current study to increase understanding of how postgraduate students read digital L2 research articles in their field of study by scrutinising observable cognitive behaviour related to reading for comprehending and learning. The participants were asked to vocalise their thoughts while attempting to comprehend a reading passage. Thus, they had to read their-self chosen research articles on the researcher's personal laptop as it has the software programme (Camtasia) (see 3.7.4 for further details about software use), which assists in the

purpose of the study. After receiving a signal, the participants had to start the TA to disclose their reading strategies during print and digital reading as well as while using digital technology during digital reading, and to justify their choices to accomplish their intended goals.

Acceptance of verbal reporting is far from universal. Critics question the validity of data gathered using this method, particularly concurrent reporting, claiming that researcher's comments and questions may interfere with the subjects' reading process, consequently influencing the subjects' verbal reporting. However, researchers typically mediate this concern by providing participants with a practice session prior to the actual verbal reporting (Dörnyei 2007 & McKay 2009). By adopting this solution in the current study (see 3.8.4 for further details about TA training), interference was eliminated during the actual study as the researcher said nothing while the subjects were reading and verbalising. Physically, the researcher remained behind the participants in an attempt to be invisible and reduce interference as much as possible during the main study.

Researchers also claim that results can be negatively affected when a researcher indicates the aspects under investigation to readers in advance of think-aloud, such as summarising or looking for main ideas. This can affect the validity of the data gathered. However, in the current study, this was effectively minimised by not cuing readers to use particular processes. The participants in the current study were also instructed to read in the same way as they would in their own reading environment, utilising their normal reading strategies without guiding them to present or produce specific strategies.

Another limitation of verbal reports, defined by Garner (1982), is the accessibility of some cognitive processes; i.e. automated processors that are below 'conscious level' are beyond reporting, as in the case of expert readers. Therefore, techniques that might be available to novice readers might be inaccessible to expert readers, as their cognitive control moves to an automated level. However, the participants in the current study are all L2 readers within an L1 academic reading context. Although they have fulfilled the language requirements (see Appendix A, Table 12, p.312) to begin their postgraduate studies in the UK, being L2 readers, is assumed to have heightened their conscious reading control over their cognitive processes. Each participant was given twenty minutes to read a digital research article and a further twenty minutes to read a printed one. Three key interrelated points from the think-aloud protocols were sought to be determined in the current study:

1. Which reading strategies do postgraduate students utilise when reading printed and digital L2 research articles related to their field of study?

2. What reading challenges do postgraduate students face while reading either printed or digital L2 research articles and how do they counter them?
3. What kinds of digital technologies (affordances) do postgraduate students use to facilitate their reading?
4. What processes do postgraduate students use during reading?

Since one of the main objectives when using think-aloud protocols is to examine readers' digital L2 academic reading strategies, a reading scheme has been developed that included specific reading strategies, in order to scrutinise the L2 on-screen reading strategies of the subjects. A basic set of strategies, PROB, SUP and GLOB mentioned in the Online Survey of Reading Strategies (OSORS) (Anderson 2003) (see 3.9.2 for further details regarding reading strategies analysis), have been adapted to investigate the functional reading strategy utilised by postgraduate students during on-screen reading.

#### **3.7.4 Audio-visual documentation**

In order to record the data accurately, digital recorders were used in the present study. Digital recorders are useful tools when following a qualitative approach as they facilitate the unfiltered collection of data (Schensul 2012 & Cohen et al. 2011). This can involve filming, audio recording, or both, to collect data for later coding and analysis while guaranteeing an accurate and detailed record of the data for later analysis (McDonough & McDonough 2004). The present study used a video camera to record the participants' paper reading, and a screen capture technique and a video camera to record their digital reading performance. The video camera and screen capture technique were both used to record the readers' digital reading strategies, to explore the challenges they faced, the strategies that they employed to overcome these challenges and their use of digital affordances while reading.

The screen capture technique used was the Camtasia Studio on-screen capture software programme (published by TechSmith). It was used to record participants' digital reading in a non-intrusive manner to maintain a naturalistic setting while reading. The Camtasia uses a camera that is fixed to the upper part of the laptop. This provided a record of the readers' face movements and voice during the digital reading process. Simultaneously, it recorded the readers' movement of the digital text on the screen and their transitions between webpages. It also made it possible to document the readers' technical behaviours, such as moving the cursor between the sentences and writing

electronic comments on the digital text. The Camtasia was installed on the researcher's university laptop at the University of Southampton.

Additional to the Camtasia record program, a normal video camera was used for three reasons:

1. To provide a backup for the films that were recorded by the Camtasia software program.
2. To capture other strategies that could not be recorded using the Camtasia software program, such as writing notes in a paper notebook, using hardcopies of dictionaries or machines, and using the mouse to move between pages.
3. To record print-based reading comprehension.

The TAs were recorded for several reasons:

1. To be transcribed, documented, coded and analysed in light of the reading strategies coding scale constructed specifically for the present study.
2. To provide rich data, and to explore and illustrate in detail the participants' behaviours and interaction with print and digital documents.
3. To reveal the duration (the minutes and seconds) that the participants required to read specific parts of the paper, such as reading the abstract of the article.
4. Finally, the recorded data can be played back and viewed several times, in order to fully scrutinise and analyse the data. The interviews and the stimulated recall sessions with the participants' answers and comments, discussed in subsequent sections, were also audio recorded using the researcher's personal recorder for later analysis. Then, the researcher transferred all the audio records to a personal computer, labelled them according to types, sorted them by participants' names, and finally saved them.

### **3.7.5 Researcher's observation field notes (FN)**

The field notes are a written account of what the researcher sees, hears, experiences and thinks during or after the interview or the observation (Tracy 2013; Bogdan & Biklen 2011; Richards 2003). They are recognised as central to observation and considered as an important supplement to other data. Field notes provide the researcher with a personal log enabling him/her to track the development of the research.

Several researchers in the field of second language reading have used FN as a method of collecting data in observed reading classrooms (Li 2009; Janzen 2007; Holme & Chalauisaeng 2006; Denton et al. 2008; Jia et al. 2006; Linek & Sampson 2006; Zhang et al. 2008). There are, however, few studies that have utilised field notes to record observations of readers' reading performance (AlKhaleefah

2010). In the present study, the field notes were used during the TA as a supplementary method for collecting and documenting data and in order to achieve triangulation. During observation of the think-aloud protocols, field notes were taken regarding the readers' reading performance while reading L2 research articles in their field of study.

There are two different types of FNs, classified according to content. These can be conjoined or separated into two different styles: reflective or descriptive (Bogdan & Biklen 2011). The reflective field note takes a subjective approach, focusing on feelings, speculation, problems, ideas and impressions. It also includes reflection on the analysis, i.e. the researcher speculates on what s/he has learnt, makes connections between pieces of data and adds new thoughts and ideas, reflects on methods and procedures, strategies and problems encountered during the study, either with the participants or others, and how to deal with these issues. Moreover, reflective field notes include corrections of previous information errors, and clarify confusing aspects.

For the purposes of the study, the researcher took notes during the TA of print-based reading and on-screen reading. Descriptive FNs were used in this study to describe details of events that occurred. They cover four areas:

1. Portraits of subjects
2. Description of physical setting
3. Depiction of activities
4. The actions of the observer

Thus, descriptive field notes made it possible for the researcher in the present study to record information about the seating, individuals, actions, and conversations. In this study, FN also included information taken from the reflective field notes including the researcher's personal interpretations of specific behaviour in the form of personal thoughts, comments and new ideas that arose during the observations. Most importantly, the field notes also make it possible to write and prepare questions during the think-aloud protocols for use as stimulated recall in order to clarify the subject's reading performance and silent instances during the reading process. Additionally, the researcher continuously took note of emerging thoughts throughout the research and writing process of this thesis.

Researchers have suggested different methods of taking FNs. Bogdan and Biklen (2011) gave the following practical advice: the field note should be established with a first page that contains information, such as title, headings, date and place of the observation. They also recommend

separation between different observations by the use of paragraphs, and leaving large margins on the left hand side of the page to provide space for annotations and coding. Cowie (2009) suggested dividing the page into three columns: on the left, details about time and place, the field notes themselves in the middle, and analytical comments in the third column. In the current study, a specific organisational approach has been followed (see Appendix J.5 for a sample of the researcher's field note).

### **3.7.6 Stimulated recall (SR) sessions**

Stimulated recall (SR) is an introspective method available to second language researchers. It prompts subjects to recall their thoughts on a specific task and event after the task has been performed (Gass & Mackey 2000; Dörnyei 2007). It is a valuable tool for investigating cognitive processes and exploring the cognition behind participants' actions (Alderson 2000). It should be conducted via stimuli that support this recall: i.e. the researcher shows participants a videotape or plays an audio recording of their actions or responses while carrying out a task, during which they are required to closely observe their own actions, thoughts and behaviour (Gass & Mackey 2011) and are asked to comment on several aspects of a written document, video or audio recording.

SR has particular applications for L2 research and L2 reading research (Dörnyei 2007). There has recently been a proliferation of studies using SR in second language reading research studies (AlKhaleefah 2010; He 2008; Walter 2007; Zhang & Duke 2008). Similarly, the current study used SR with the participants. It constituted the second main instrument. As each reader reached the end of the twenty minutes allocated for digital and paper reading, the SR technique was employed by replaying video recordings of the task (think-aloud protocol) to the participants. This enabled the observation of their spontaneous responses during the activity and elicited their comments on their own strategy and behaviour while reading the research articles. According to Gass and Mackey (2011), data should be collected immediately after the event, in order to ensure full access to recent memory and to reduce recall interference (i.e. the participants saying what the researcher wishes them to say). In this study, during the SR, the recorded video was replayed and displayed to the participants to stimulate further detailed recall. According to Gass and Mackey (2011), a tangible reminder of the event is effective in stimulating the recall of mental processes during the events. While the participants were watching the video, the researcher paused it where necessary, to request clarification and/or a description of the processes that they were employing during their silent reading. The SR sessions were recorded using a voice recorder for later analysis.

During the SR sessions, five main aspects were the focus of the SR:

1. Employed reading strategies
2. The purposes of employing specific strategies
3. Reading challenges
4. Ways to overcome the challenges
5. Using digital affordances

The SR method is employed in the current study as it usefully enriches the data, mitigates the drawbacks of the think-aloud protocol and extends the scope of the research study. First, it provides the researcher with indirect access to the readers' cognitive processes through the interpretation of those processes by the reader during their silent reading in the videotaped think-aloud session, as some readers do not verbalise every aspect of their reading comprehension. The SR method has made it possible for the researcher to make the most of the data collection method by asking questions and getting explanations and clarifications about the silent pauses in the reading process.

Second, it makes it possible to gain maximum insight into the participants' natural reading of L2 digital research articles to achieve an accurate understanding of individuals and reality (see 3.2 for further details about the research paradigm). Third, it allows participants to identify and illustrate their reading strategies and the challenges that they experience during L2 academic reading and the way in which they solve problems with comprehension. Fourth, it enables the researcher to access the reasoning processes that underlie the readers' cognitive activity and to explore their metacognitive knowledge about the reading strategies used through participants sharing their explanations and justifications vividly and accurately, using each strategy in a specific instance.

Fifth, it facilitates integration of the data collected from the participants' long-term memory with that collected from the think-aloud protocol (short-term memory). This enhances the richness of the data and ensures that no data regarding the cognitive reading process of the participants is missed. More importantly, it increases the reliability, credibility and validity of the data as results can be combined with the other data collected via other research methods, namely think-aloud protocols, interviews and field notes.

### **3.7.7 Semi-structured Interviews (Intvw)**

The primary and most commonly used method in the qualitative approach is the one-to-one interview (Barbour 2009). Interviews can be the dominant method of data collection or may be employed alongside other methods, such as observation and document analysis. Interviews have

been used widely in applied linguistics. They have been used by researchers seeking data on the stages and processes of second language acquisition, and by language examiners aiming to assess learners' language proficiency (Nunan 2006). This method is essential in establishing the background experiences and practices of the participants', and is adopted when researchers wish to understand the impressions, attitudes, feelings, motivations, perspectives, or experiences of an individual fully. It also enables evaluation and assessment of specific aspects of participants.

There are several types of interviews in qualitative research; structured, semi-structured and unstructured (Friedman 2012). These vary according to the amount of control employed by the researcher and the types of questions. Structured interviews are the most formal and controlled method. They are based on specific questionnaires used in survey research, such as telephone interviews and political polling. Most questions are closed-ended, directing the interviewees to select between pre-prepared answers. The interviewer controls the content of the interview rigidly, with no room for the subject's own words to be presented (Bogdan & Biklen 2011). Unstructured interviews, on the other hand, allow the researcher 'to follow the interviewee in unpredictable directions, with only minimal interference from the research agenda' (Dörnyei 2007, p.135). A compromise between these extremes is provided by the semi-structured interview. This is the type of interview most widely used in linguistic research and is the method adopted for this study. Details are as follows.

Semi-structured interviews comprise open-ended questions focused around specific topics and guided by general questions (Bogdan & Biklen 2011). During semi-structured interviews, the researcher is eliciting data rather than dictating the answers to the respondent (Barbour 2009). Researchers usually have a clear vision of the direction and results, with the conversation being determined by topics and issues rather than fixed questions (Nunan 2006). The majority of qualitative researchers prefer the semi-structured interview for its ability to collect in-depth data, to discuss and locate current problems and to analyse actual practices (Ibid.). Interviewees are given a degree of control over the direction of the interview, which encourages them to speak without reserve and to communicate in a deeply personal way (Nunan 2006 & Barbour 2009).

Thus, in the current study, semi-structured interviews allow new insights into the experiences and perspectives of the participants and permit the gathering of in-depth data. It is a flexible method that enables respondents to speak freely about themselves (Dörnyei 2007), so in the current study, it allowed unexpected data to emerge. Semi-structured interviews provide a great deal of flexibility, as questions can be altered in response to the direction that the conversation takes. Most importantly, the semi-structured interview has been chosen for use in the current study, as there are several

variables to be considered which would cause difficulties if using structured questions or a questionnaire, as outlined above. It also enables the researcher to investigate the participants' L2 reading experiences and perceptions in depth.

However, such interviews have disadvantages, being time-consuming to set up and conduct, and requiring good interactive skills to elicit appropriate responses. Moreover, the large volume of information generated by this method becomes difficult to transcribe and analyse. For this reason, in the current study, time was spent organising the questions efficiently, and only one participant was interviewed per day. Furthermore, the interview questions were piloted with postgraduate students in the researcher's field, who gave feedback on both the questions and the interviewing techniques (see 3.8.1 for further details about the pilot study). The data collected is therefore accurate, fully reflecting the intention of the research. When it comes to the large amount of data collected, as the current study is a case study and its main goal is to investigate deeply and incisively, it is an advantage to collect a large volume of data. In order to avoid any confusion and hindrance as a result of the use of L2, the interviews took place in the participants' first language (Arabic). The data were recorded for transcription, translated and analysed (see 3.9.1 for raw data exploration). A sample of the original Arabic version for the used quotes is presented in Appendix J.4.

The semi-structured interviews in this study comprised three different purposeful categories; descriptive, experience and behaviour; each of which included a sequence of sub-questions for deeper analysis. The first set of questions was descriptive, and aimed to collect information about the readers' reading practices when interacting with the academic text on-screen and the challenges that they experience while reading. The second set of questions dealt with the readers' experience and aimed to gather information about their previous and current academic reading practices. The third set of questions was a cluster of behavioural and attitudinal questions designed to collect information about readers' perceptions, preferences, and the use of on-screen and print-based texts.

Two sets of interview questions were designed. First, a cluster of eight questions was designed specifically for the PhD participants (see Appendix C.1). In the first phase, a similar cluster as those for the PhD interview, consisting of eight questions was used to interview the Master's participants. The PhD and the first phase interviews with Master's students were in-depth and lasted for approximately one hour and thirty minutes in order to gather their responses from several angles:

1. Their previous L1 and L2 academic reading education
2. Their previous (both printed and digital) academic reading practices
3. Their previous academic L2 reading course
4. Their current reading practices in the UK including their reading strategies and reading source preferences
5. Their use of the e-resources during their L2 academic reading and their perceptions regarding the digital technology and its role in enhancing their L2 academic reading
6. Their L2 academic (digital and printed) reading challenges and how they overcome them throughout their postgraduate study
7. Their perceptions regarding the changes that had occurred to their L2 academic reading since they were in their home country and since they started their postgraduate study in the UK.
8. Their perceptions of the individual, social and educational factors that had caused these changes. Moreover, the participants were questioned about some of reading strategies that the researcher had noticed, checked, and unchecked in the reading strategies scheme during the think-aloud session

Another set of questions was designed to interview Master's students during the second phase of collecting the data (see Appendix C.2). In the second phase, a similar cluster, this time of six questions, excluding the questions concerning participants' previous reading practices and their received reading education, was prepared to interview the Master's student participants. This time, the interviews lasted for only forty minutes. The order of the used instruments is mentioned in 3.8.3.

### **3.7.8 Demographic questionnaire**

In the present study, a questionnaire was created in order to gather demographic background information about the PhD and Master's participants (see Appendix A.1) According to Pressley and Hilden (2011), in studying adult reading, there is a need to be aware of the participants' educational level and previous reading achievement. Therefore, in the current study the questionnaire is used at first to obtain data considered as a minor variable that may have an impact on participants' current L2 digital academic reading comprehension.

The questionnaire was designed to collect specific information about the research participants, such as their age, when they started studying English, their previous English language test results, their own perceptions of their level of English language proficiency and their reading and writing skills (both before and during their studies), the number of years they had been in the UK, the stage at

which they first started receiving digital skills education, their bachelor degree disciplines, their current postgraduate major and their perceptions about the importance of digital reading. Appendix A represents a summary of the demographic data for the participants.

In the present study, there are advantages of using fixed questions to collect demographic information about the participants rather than using demographic semi- or unstructured interviews. Some participants may find it embarrassing to reveal their age or low level of language to the researcher, even though they know it is confidential. They may find it easier to reveal the truth in the privacy of the written word. This also saves time and energy, with the participants choosing one of the written answers rather than the researcher asking questions and the subject then generating answers that then have to be recorded, translated and transcribed.

### **3.8 Data collection procedure**

#### **3.8.1 The pilot study**

Gass and Mackey (2011) defined a pilot study as a 'small scale trial of the proposed procedures materials and methods' (p.3). They asserted that the pilot study is a crucial element for any study before collecting the main data, as it tests, revises and finalises the material and methods for the main study (ibid 2011). Gass and Mackey (2011) also maintained that the pilot study assists researchers in solving problems in the design and prevents complexities from occurring in the main data collection. It also enables the researcher to establish if the questions yield the required data and to eliminate those that have no role, while modifying those that are ambiguous or confusing (Nunan 2006).

It was therefore important to test the methods of the current study, i.e. the demographic questionnaire, the TA techniques, SR, and interviews. There were several reasons for conducting a pilot study. First, the pilot study prepared for the main collection of data by which a group of students in postgraduate programmes at the University of Southampton would be investigated. Second, it was conducted to practise the mechanisms and practicality of data collection procedures and to test the validity and reliability of the methods of the present study. Third, it enabled feedback to be collected; and ambiguous, difficult and non-contributing questions to be reworded or discarded. Fourth, it enabled the researcher to record the time taken by the students during each procedure. Fifth, it allowed scrutiny of the data gathering techniques to determine which produced

the most fruitful data. In this case, it also helped the researcher to identify the different types of data and to establish the mechanics of data analysis, i.e. transcribing the data and following particular transcription schemes. Sixth, it directed the researcher to focus on the participants' metacognitive reading strategies, as some of them were evaluating their reading processes while reading. Finally, the pilot study familiarised the researcher with the research methods.

The pilot study was carried out in Southampton between the 1<sup>st</sup> and 30<sup>th</sup> October 2012. The interviews and demographic questionnaire were piloted with three international postgraduate students (from Mexico, Chile and China) and with five postgraduate Saudi students who, at the time, were full time research students in the UK. Three came from the school of Humanities; one was from the school of Management, and one was from Health Science. These mixed nationalities were chosen in order to gain feedback from different perspectives. Also, candidates were both similar and different to those for the main study to make certain that there were no major differences between Saudi students and other international students studying in the UK context. Postgraduate students were chosen, as they were comparable to the participants in the main study.

The first part of the pilot study involved distributing the demographic questionnaire in order to gain the participants' demographic information. The organisation of these questions was improved by this information. It proved useful in terms of questions subsequently being reordered and numbered for the purposes of clarity. The original intention was to use the Anderson's (2003) OSORS survey (mentioned in 2.5.1) as one of the research instruments. However, during the pilot, drawbacks of the questionnaire were revealed regarding data collection, as the sub questions proved confusing and tedious. For example, the questionnaire was limited to providing information about what strategies the subjects think they employ during reading, but it did not illustrate the real and complete reading process discussing how, when, and why each strategy was used. It limited the participants' answers and left no room for unexpected data to be generated. Due to the poor quality of the data gained from the pilot study, and the complexity of the main study, it was considered best to retain the demographic questionnaire section, and to transform the remainder of the text into semi-structured interview questions. The pilot study interviews lasted approximately an hour, ranging from sixty to ninety minutes each. Each interview was audio-recorded.

Piloting the interviews provided an opportunity to practice the interview procedures. The interviews sought to address any unclear questions or identify additional questions that should be asked from the interviewees' perspective. At this stage, the participants were asked to give their opinions freely about the interview questions, and they provided very useful feedback, i.e. to avoid repetition and when wording questions to keep them simple, clear and specific. Comments from the pilot led to a

rethinking of the order of the questions, and helped the researcher to categorise the interview questions, and reorder them to create an interlinked interview. Moreover, the interviewees also commented on the length of the interview. Some of them advised the researcher to minimise the time spent on the interview session. The pilot interviews also revealed a reoccurrence of some of the questions, which generated repetition in the answers. Consequently, all the repeated questions were deleted and the number of interview questions was reduced as much as possible without affecting the research objectives. Moreover, the pilot revealed that the questions should not be limited to those written beforehand but should follow the flow of the conversation, as this method generated more information. This led the researcher to develop more questions based on the respondents' answers. For example, when the researcher asked the participants about their previous reading practices in their home country, they mentioned several aspects that the researcher felt were essential to include, such as the availability of digital services that support digital reading in their home country and their knowledge of using digital affordances during reading.

The interview questions were originally only in English with all the participants, Arabic and non-Arabic speakers answering in English. However, Arab speakers were free to answer in English or/and in Arabic. After piloting this, it was found that conducting the whole interview in Arabic with the Arab students produced more and better responses from the participants and some of the interviewees had already asked the researcher during the pilot interview to repeat the interview questions in the Arabic language. Thus, the researcher translated the interview questions from English to Arabic to be used during the main study.

The think-aloud protocol and SR were also piloted with a Chinese PhD student, a Mexican and a Chilean student from the School of Humanities and a further two PhD students, one Saudi from the School of Humanities and the other Kuwaiti from the School of Health Science. This was useful for practicing and becoming more familiar with the TA and SR techniques. Moreover, it generated a new concern that needed to be considered for example, focusing on the participants' awareness of the employed strategies, to illustrate why they utilised specific strategies and not the other. This also enabled the researcher to determine an appropriate period of time for the participants' on paper and digital reading in the main study, as it was discovered that if they read for more than forty minutes without a rest, their concentration was affected, which could influence the data; therefore twenty minutes was decided to be a suitable length of time for each reading activity.

### **3.8.2 Ethical considerations**

The ethical issues of the current study have received fair consideration. Prior to collecting the main study data, ethical procedures were approved by the Research Governance Office (RGO) on the 8th of October, 2012. The participants' permission was sought to carry out the study. When they agreed to do so, they were provided with formal information about the researcher with a clear introduction about the research, and a brief explanation of its purpose. A consent form was also given to the participants in order for them to sign and confirm their acceptance to participate in the study (see Appendix D for the consent form). In addition, the researcher orally informed the participants that their participation was voluntary and that they had the right to withdraw at any point. They were also informed that pseudonyms would be used when presenting the findings and that their faces would be hidden in the video recordings. The participants were reassured that all the data collected, even that which was recorded, would be used for the sole purpose of the study. This chapter will continue to outline the procedures that were used for conducting this study.

### **3.8.3 The main study: order of procedures**

This section describes the actual research and the order of the procedures followed during collecting the data. The main study took place at the University of Southampton, in the UK. Saudi PhD and Master's students from differing disciplines were recruited via a voluntary response and snow-ball sampling methods. They were invited by letter to participate in the study, (see Appendix E for the invitation letter), through the Southampton Saudi Club on Facebook and Twitter; and by asking the initial subjects to identify another subject who also met the criteria of the research. Several students were willing to participate. Before meeting any of the participants, each one was contacted via either email or phone to ensure they met all the specified criteria for participating in the current study (see 3.4 for further information about the research participants). If so, a brief introduction about the study was given to them and they were asked to prepare and bring two research articles from their field of study that they had not previously read; one printed and the other online (see Appendix B for text selection criteria).

All the sessions pertaining to the study took place at the main Hartley Library at the University of Southampton. A study room in the Hartley Library (the main library of the University) was booked for these meetings. This room was chosen as it was quiet, relaxing and a convenient place for participants to engage in their reading and to be able to video and audio record their TA, SR, and the interviews. In addition, the video camera for each meeting was hired a week in advance from the

University of Southampton (ISolutions) and delivered to the specified room in the Hartley library. The researcher prepared the material and directed the video camera at the reader's seat.

The participants individually met with the researcher at the specified room and filled in the demographic questionnaire prior to starting the TA. It only needed five minutes to be completed as it is relatively short and concise. The researcher chose to start with the demographic questionnaire as some of the responses would help to interpret the subjects' reading behaviours during the think-aloud protocol, for example, knowing that the participant's language of curriculum during her Bachelor's degree was Arabic, enhanced the researcher's interpretation of the reader's reading behaviour and thus the researcher could focus questions during the SR and the interview on the role of Arabic for understanding English material.

The think-aloud followed by the SR were conducted with each participant twice; once with the participant reading from printed paper format and once with them reading on-screen. The value of having the same participant read one printed article and another one on-screen is that it reveals the differences and similarities between reading in different formats. Initially, a demonstration in the first language of the participants (Arabic in this context) about the think-aloud (see Appendix F) and stimulated recall (see Appendix G) was provided. The TA sessions, researcher's FNs, SRs followed by the interviews were conducted twice with the Master's students. The first phase was carried out between November and December 2012, with the second session held between March and April, 2013. The PhD participants each had only one TA session, field notes, stimulated recall and interview, which were held between November and January 2012/2013. All the data were saved on the researcher's university laptop and a backup was stored in the cloud storage (Dropbox) and on an external hard-drive.

Regarding the Master's participants, the reason for collecting the data a month after the starting date of the students' programme was that at the beginning of their course, the students are not fully concentrating on their academic reading. This is due to practical issues that need to be resolved, such as visas and accommodation. During all three methods, the researcher informed the participants that they were free to report and respond in Arabic or English, according to their preference, in order to encourage richer responses and more in-depth information.

The meeting began with a warm-up conversation. The researcher then provided the participant with the consent form to be read and signed (see 3.8.2 for ethical consideration). The researcher

explained the consent form and made sure that the participants understood everything related to their participation in the study.

#### **3.8.4 Think-aloud training sessions**

Prior to starting the first main think-aloud approach to collecting the data, a short training session was held (on the same day) with each participant to increase the content validity of the verbal report. According to Ericsson and Simon (1993) and Dörnyei (2007), subjects should be introduced to the think-aloud technique by providing them with precise instruction and training. Thus, the training in the current study was to guarantee the generation of appropriate data using the TA.

However, the training does not guarantee that the participants expressed all their thoughts and described all the processes that they employed to comprehend the written text. Some of the participants spoke less than others, and gave very brief explanations during the think-aloud protocols. Thus, the SR sessions were necessary to collect more detailed data (see 3.7.6 for further details regarding the stimulated recalls).

Initially, a demonstration in the first language for the participants was provided. They were then instructed to verbalise their thoughts as far as possible in English or in their first language. They were also instructed to read the L2 research articles as they usually would (see Appendix F for directions to think-aloud).

The researcher then demonstrated the think-aloud technique, using a research article with each participant and illustrating the manner in which they should report and verbalise their thoughts while reading. The researcher role played how to read and think-aloud, while being very cautious not to mention any specific strategies in order not to influence the participants. In order to practice, the participants were then provided with a short unfamiliar text in English (see Appendix H for the training text) with which they practiced reading and verbalising. Training along these lines was continued until such a time as the subjects felt at ease with the procedure and were able to verbalise naturally without undue self-awareness. The training session lasted for approximately twenty minutes.

(Continued overleaf)

## **3.9 Understanding on-screen academic reading: A pathway into analysis**

### **3.9.1 Raw data exploration**

This study involves the collection of a large amount of qualitative digital raw data, as this was deemed to be the most appropriate approach for the current study objectives. The data consists of:

1. 50 think-aloud sessions with a total time of 16 hours, 20 minutes (Phase one: 6 hours and 40 minutes on-screen reading, 6 hours and 4 minutes paper reading; Phase two: 1 hour and 40 minutes on-screen reading and 1 hour and 40 minutes paper reading)
2. 50 stimulated recall sessions with a total time of approximately 31 hours and 20 minutes (Phase one: 13 hours on-screen reading, 13 hours paper reading; Phase two: 2 hours and 40 minutes on-screen reading and 2 hours and 40 minutes paper reading)
3. 27 interview sessions, adding up to a total of 34 hours and 20 minutes
4. 50 field notes (40 phase one and 10 phase two)
5. 20 demographic questionnaires

Fourteen sources of data have been collected from each of the Master's participants (see Appendix J.6 for Master's data sources visualisation) and seven sources of data have been collected from each of the PhD participants (see Appendix J.7 for PhD's data sources visualisation).

The data analysis took the form of exploration, explanation, interpretation and evaluation. The L2 academic reading practices of the participants were explored with regard to the reading strategies employed during paper-based and on-screen reading, their use of e-resources, source-reading preferences, their reading challenges, the ways that they overcome these challenges and the changes that have occurred in their reading practices. Explanations and interpretations of the factors that have contributed to a change in their digital academic strategy literacy (DASL) and on-screen reading practices were provided. An evaluation of readers' on-screen reading and interaction with e-text has been discussed (see chapter 6).

#### **The researcher made three main decisions when analysing the data:**

1. The analysis of the data in the present study has been organised by research question (Cohen, Manion & Morrison 2011). Thus, the researcher analysed and presented the data according to the research questions outlined in 2.7, by drawing together all the relevant data that were gathered from different sources.

2. In order to gain a larger number and a bigger picture, data from the Master's students in the second phase was combined with data from the PhD students, and this data was analysed as a single group of postgraduate readers. This was done as it was found that the differences between the two groups (Phase 2 Master's students and PhD students) were not large and were entirely based on the quantity of strategies employed rather than the types of strategies. In other words, the differences between the five Master's students in the second phase and the fifteen PhD students were not great, and these differences were not statistically significant. Additionally, the second phase of the Master's degree (rather than the first) was chosen to make sure that the participants all had a similar amount of time to get used to academic reading in the UK context and that they were familiar with the basics of digital academic reading.
3. Although the research aim was to look at the full range of strategies and present its breadth rather than highlight the differences between the participants' groups, in 6.5.4 of the thesis, the researcher segregated the data and demonstrated the differences between the reading of the Master's participants in the two phases; and compared the Master's student readers in the first phase with the PhD student readers.

During the present study, the researcher created a separate online folder for each participant and allocated a pseudonym to each one on the researcher's computer and sorted again on NVivo software (see 3.9.6 for details about using NVivo). Each folder contained all the digital data collected from each participant; the audio recording, video recordings, the transcript, the field notes and their reading texts. The first step for adequate analysis of the interviews, the think-aloud protocols and SR data is transcription. The transcription of the TA and the SR visualise the reading process of the reader. Therefore, the raw data of the think-aloud, the SR, and the interviews were transcribed (see Appendices J.1, J.2 & J.3 for transcription samples) and most of them were concurrently translated from Arabic into English. The researcher looked at the surface layer and at all the transparent and evident strategies for all the participants and then scrutinised for deeper and hidden strategies. The researcher also observed the chronological order of the strategies in order to come to a deeper understanding of the employed reading strategies. Several new strategies emerged inductively from the data that are presented and discussed in the following section. Screenshots of the video recordings of some of the reading strategies employed by the readers were taken and used in the data analysis Chapter (see Appendix K for screenshots of data collecting procedure) as a means of presentation and illustration.

### 3.9.2 Analysing reading strategies

Based on the research studies explained in 2.5.1 and the subsequent explanation in this section, this study set out to adopt an academic reading strategy scheme to identify and explore the on-screen academic reading comprehension strategies used by postgraduate students when reading L2 academic research articles in their field of study. Table 2, which was amended after data analysis, presents the original scheme of the reading strategies based on (Chun & Thompson 2008; Anderson 2003; Huang 2009); and Table 7, p.141 presents (in no particular order) the final suggested version of the on-screen reading strategy scheme (ORSSC) based on the data in this study. The names, definitions and examples of the different strategies are listed in Appendix I, Table 16, p.338.

<b>On-screen reading strategy scheme (ORSSC)</b>		
<b>1. Problem-solving reading strategies (PROB)</b>	<b>2. Support reading strategies (SUP)</b>	<b>3. Global reading strategies (GLOB)</b>
<ol style="list-style-type: none"> <li>1. Changing reading rate</li> <li>2. Re-reading</li> <li>3. Using context</li> <li>4. Translating using hard copy dictionaries</li> <li>5. Translating electronically</li> <li>6. Parsing sentences</li> </ol>	<ol style="list-style-type: none"> <li>1. Marking the text</li> <li>2. Making a summary</li> <li>3. Taking notes</li> <li>4. Reading aloud</li> <li>5. Formulating questions</li> <li>6. Paraphrasing</li> <li>7. Reviewing</li> </ol>	<ol style="list-style-type: none"> <li>1. Using visual aids</li> <li>2. Previewing</li> <li>3. Locating key words</li> <li>4. Identifying main idea</li> <li>5. Attending selectively</li> <li>6. Skipping</li> <li>7. Using background knowledge</li> <li>8. Anticipating</li> <li>9. Planning</li> <li>10. Having a purpose</li> <li>11. Mind mapping ideas</li> <li>12. Scanning</li> </ol>

Table 2: Initial on-screen reading comprehension strategy scheme (ORSSC)

As this study aims to explore readers' utilisation of technology and the nature of the on-screen reading strategies they use during actual academic reading, via think-aloud protocols and SRs methods, the OSORS reading strategy categories are initially adapted in the current study as they represent the main functional strategies used by readers:

- 1. Support (SUP)**
- 2. Problem-solving (PROB)**
- 3. Global (GLOB)**

(Anderson 2003)

However, the research does not make use of the OSORS reading sub-strategies, as these were originally formulated for use via the survey method, which does not feature in this study. Instead, some of the reading strategies suggested by Huang et al. 2009 are adopted, namely:

- 1. Using grammar resources**
- 2. Adjusting the reading speed**
- 3. Making visual presentations of ideas (mapping)**
- 4. Reading aloud**
- 5. Having a purpose**
- 6. Previewing**
- 7. Using electronic dictionaries and locating keywords**

(Huang et al. 2009)

Furthermore, other reading techniques have been adopted from Chun and Thompson's (2008) study in addition to the reading strategies of Huang et al. (2009):

- 1. Scanning, marking the text**
- 2. Re-reading**
- 3. Skipping**
- 4. Translating using hardcopies**
- 5. Using visual aids**
- 6. Using context**
- 7. Previewing**
- 8. Paraphrasing**
- 9. Using background knowledge and personal experience**
- 10. Anticipating**
- 11. Formulating questions**
- 12. Identifying main idea**
- 13. Taking notes**
- 14. Summarising**
- 15. Planning**

## 16. Attending selectively

(Chun and Thompson 2008)

The justifications for the choice of the previous strategies are varied. Firstly, Chun and Thompson's (2008) strategies represent the two main reading processes (bottom-up and top-down) which are essential in second language reading comprehension and one of the areas on which the current study focuses (see 2.6.1 for cognitive reading approaches). Secondly, Chun and Thompson (2008); and Huang et al. (2009) grouped the selected reading strategies that were previously mentioned according to the actual reading processes used by university students, as explained in previous studies. Thirdly, they were proposed by second language readers in the academic field. Fourthly, these strategies are adopted in the current study as they are considered to be reliable reading strategies employed by second language readers during actual reading, and scrutinised via think-aloud protocols.

The researcher in the present study grouped the aforementioned selected sub-strategies into the three reading categories, according to their function (see Table 3, p.128 for an illustration). For example, changing reading rate and translation are categorised as 'problem-solving' reading strategies, as their functionality is to enable readers to solve comprehension problems. Strategies that support reading comprehension are classified as 'support' reading strategies, which include marking the text and summarising. Finally, strategies including previewing and using background knowledge are classified as 'global' reading strategies, as these enable readers to manage their reading and invoke their own experience to help comprehend the text.

By doing so, an on-screen reading comprehension strategy scheme ORSSC (see Table 2, p.125) has been formulated. This scheme was used for the 'think-aloud' protocol in this study, in order to assess the reading strategy categories and sub-strategies that readers utilise, as well as during the SR and the interviews, to discuss with the readers some of the observed and unobserved strategies.

The sub-reading strategies are analysed in this study according to two main themes:

1. Their function; for example, problem-solving, supporting and global (see 4.2).
2. Their application during interaction with different levels of text, including text level, section level, paragraph level, sentence level and word level (see 4.3).

Functional reading strategy	Definition	Example
1. <b>Problem-solving reading strategies (PROB)</b>	Mechanisms that enable readers to solve comprehension problems and overcome reading comprehension challenges	<ul style="list-style-type: none"> <li>▪ Re-reading</li> <li>▪ Using context</li> <li>▪ Parsing sentences</li> </ul>
2. <b>Support reading strategies (SUP)</b>	Mechanisms that aid and foster readers' reading comprehension and enable readers to achieve a better understanding of the text	<ul style="list-style-type: none"> <li>▪ Marking the text</li> <li>▪ Taking notes</li> <li>▪ Reviewing</li> </ul>
3. <b>Global reading strategies (GLOB)</b>	Mechanisms that enable readers to manage and monitor their reading process and involve their previous experience to comprehend the text	<ul style="list-style-type: none"> <li>▪ Having a purpose in mind</li> <li>▪ Planning</li> <li>▪ Anticipating</li> </ul>

Table 3: Reading strategy categories - definitions and examples

Throughout reading, readers in this study exhibited a number of sub-strategies for interacting with and comprehending the text on-screen. These are illustrated and exemplified elsewhere (4.2.1, 4.2.2, 4.2.3 & 4.2.4) and discussed in 6.2.1

In the current study, during readers' interaction with the academic text on-screen, they frequently employed strategies that were not part of the original reading strategy scheme presented in Table 2, p.125, in order to achieve comprehension. Through the study, a new set of reading strategy categories and twenty-two sub-strategies have been identified. Table 4, p.129 presents only the new reading strategies and outlines their function.

These strategies are categorised according to the previously selected reading strategy functions; GLOB, SUP and PROB. The data also led to the addition of a fourth functional reading strategy: critical (CRT). This fourth category has been given a critical function as a group of sub-reading strategies were directed toward critically thinking about the content of the text.

In the present study, the new set of sub-strategies is grouped as follows; problem-solving reading strategies (PROB) which include, pausing, thinking and pointing; support reading strategies (SUP) which include, vocalising electronically, confirming, pausing, thinking, pointing, continuing to read, mentally visualising text content, making connections between text content, changing physical reading position, using computer functions; global reading strategies (GLOB) which include, pausing, thinking, using text references and making connections between ideas; and critical reading strategies

(CRT) which include, evaluating the information, evaluating the source of the information, evaluating the language and evaluating the style.

<b>New on-screen reading strategies</b>			
<b>1. Problem-solving reading strategies (PROB)</b>	<b>2. Support reading strategies (SUP)</b>	<b>3. Global reading strategies (GLOB)</b>	<b>4. Critical reading strategies (CRT)</b>
<ol style="list-style-type: none"> <li>1. <u>Pausing</u></li> <li>2. <u>Thinking</u></li> <li>3. <u>Pointing</u></li> </ol>	<ol style="list-style-type: none"> <li>1. Vocalising electronically</li> <li>2. Confirming</li> <li>3. <u>Pausing</u></li> <li>4. <u>Thinking</u></li> <li>5. <u>Pointing</u></li> <li>6. Continuing to read</li> <li>7. Mentally visualising text content</li> <li>8. <u>Connecting text content</u></li> <li>9. Using computer functions</li> </ol>	<ol style="list-style-type: none"> <li>1. <u>Pausing</u></li> <li>2. <u>Thinking</u></li> <li>3. Using text references</li> <li>4. <u>Connecting ideas</u></li> </ol>	<ol style="list-style-type: none"> <li>1. Evaluating the information</li> <li>2. Evaluating the source of the information</li> <li>3. Evaluating the language</li> <li>4. Evaluating the style</li> </ol>

Table 4: Newly identified set of on-screen reading comprehension strategies

The strategies explained and exemplified in the following sections led to the modification and reconstruction of the original reading strategy scheme (mentioned in Table 2, p.125) and (see 4.2, Table 7, p.141 for the modified and the proposed on-screen reading strategy scheme; and see Appendix I for the names, categorisation, definitions and examples of these sub-strategies). Two of the original sub-strategies have been removed as neither of them were used during the current study by any of the readers under investigation. These are parsing sentences and using hard copy dictionaries. However, the categorisation of some of the new sub-strategies is confusing, as four sub-strategies can be listed under more than one strategy type, as they have multiple functions (see underlined strategies in Table 4). In order to resolve this issue, TA and SR data was revisited and re-analysed to identify the reasons underlying the use of these sub-strategies, in order to categorise them more accurately in relation to the main strategies.

### **1. Pausing**

Readers reported that they pause either to analyse certain information, or to think about it, if they find it difficult to understand. In this case, pausing functions as both a support strategy (see 4.2.2 for examples) and a problem-solving strategy (see 4.2.1 for examples). However, pausing can also be considered as a global strategy, as readers sometimes pause in order to think about and make connections between information within the text and their own background knowledge.

### **2. Thinking**

Thinking has been classified as a global reading strategy, as the readers in some instances were thinking about related information that they had read in other sources. On the other hand, sometimes they were thinking about the sentences' literal meaning or the author's point of view. These processes can be considered as support reading strategies. It also could be a problem-solving strategy as readers in specific instances think in order to comprehend difficult information (see 4.2.1 for examples).

### **3. Connecting ideas**

Another kind of sub-strategy, which could be categorised as a support, problem-solving or global reading strategy is that of making connections between ideas. The readers were sometimes making connections between the information that they were reading, and information that they had read previously in another source. In another instance, they were connecting information with the text itself to solve a comprehension problem or to support their reading comprehension (see 4.2.2 for examples).

### **4. Pointing**

Pointing is another sub-strategy that has been observed during academic reading. Investigating the reasons behind pointing suggests two functions. Readers were pointing because this kind of strategy increases their focus and helps them to track the sentences that they are reading. Thus, they are using it as a support reading strategy. In other instances, readers were pointing during their reading because they needed to pick up the thread of their reading, after losing it because they had to do something else, such as translating or navigating other websites. In this case, pointing is categorised as a problem-solving and support reading strategy (see 4.2.1 for examples).

### **3.9.3 Analysing reading processes**

The previously mentioned sub-strategies are analysed in the current study in reference to the interactive reading approach, which consists of bottom-up and top-down processes (see 2.6.1 for further details about cognitive reading processes). The sub-reading strategies located within the original reading strategy scheme (see Table 2, p.125) as well as the new set of strategies that emerged from the data, which are presented in Table 4, p.129 are grouped into two categories, bottom-up and top-down approaches, to illustrate the nature of the processes of on-screen L2 academic reading. Table 5, p.132 presents the categorisation of the sub-strategies according to these two reading processes.

The principles used to differentiate between top-down and bottom-up processes here are based on previous research (presented in 2.6.1), and the researcher's thoughts of the definitions and functions of top-down and bottom-up processes. A top-down process enables readers to obtain a holistic view of a text based on a higher level procedure in which readers integrate expectation and assumptions, select relevant text content and apply previous experience and knowledge to the text. In the current study, the top-down processes are comprised of twenty reading strategies. On the other hand, a bottom-up process enables readers to support their reading comprehension or solve a reading comprehension problem based mainly on their interaction with the text via a lower level procedure, such as translating words and/or re-reading. In the current study, the bottom-up processes are comprised of twenty-three reading strategies.

Chun and Thompson's (2008) classification scheme of top-down and bottom-up strategies is adopted to support the strategy classification in the current study. Two PhD researchers were also consulted to ensure the reliability of the reading strategy categorisation. The names, definitions and examples of strategies are all listed in Appendix I. In this study, twenty-five reading strategies are categorised as being bottom-up processes and twenty as top-down processes. Three reading strategies, pausing, thinking and making connections between texts' content, are classified under both processes, as it is thought that these could be utilised to interact with a text via either a top-down or a bottom-up process.

(Continued overleaf)

<b>Interactive reading approach</b>	
<b>Top-down process</b>	<b>Bottom-up process</b>
<ol style="list-style-type: none"> <li>1. Evaluating the information</li> <li>2. Evaluating the language</li> <li>3. Evaluating the source of the information</li> <li>4. Evaluating the style</li> <li>5. Formulating questions</li> <li>6. Anticipating</li> <li>7. Attending selectively</li> <li>8. Identifying main ideas</li> <li>9. Planning</li> <li>10. Using background knowledge</li> <li>11. Mind mapping ideas</li> <li>12. Taking notes</li> <li>13. Confirming</li> <li>14. Connecting ideas (ideas level)</li> <li>15. Having a purpose</li> <li>16. Pausing</li> <li>17. Thinking</li> <li>18. Previewing</li> <li>19. Mentally visualising the text content</li> <li>20. Using text references</li> </ol>	<ol style="list-style-type: none"> <li>1. Making a summary</li> <li>2. Locating keywords</li> <li>3. Skipping</li> <li>4. Paraphrasing</li> <li>5. Scanning</li> <li>6. Using context</li> <li>7. Re-reading</li> <li>8. Changing reading rate</li> <li>9. Using visual aids</li> <li>10. Vocalizing electronically</li> <li>11. Translating electronically</li> <li>12. Marking the text</li> <li>13. Reading aloud</li> <li>14. Continuing to read</li> <li>15. Ignoring difficult parts</li> <li>16. Pausing</li> <li>17. Thinking</li> <li>18. Reviewing</li> <li>19. Ignoring difficult parts</li> <li>20. Pointing</li> <li>21. Connecting text content (text level)</li> <li>22. Changing physical reading position</li> <li>23. Using computer functions</li> </ol>

Table 5: Interactive reading approach (top-down & bottom up)

### 3.9.4 E-text resources

In this study, the NCS-eT typology of e-text resources (Anderson-Inman, 2009), which presents the technological affordances that are available during reading text on-screen, is adopted as a baseline scheme for the analysis of readers' use of on-screen reading resources. Anderson-Inman's taxonomy is adopted as it contains the most applicable e-resources that digital users employ during e-text interaction. It also includes various aspects of e-resources that readers may use during an on-screen reading task, such as presentational and collaborative e-resources (see 2.5.5 for further details about digital reading affordances). This typology has not yet been tested on postgraduate students, and its applicability to this group of students has yet to be assessed. Thus, the researcher judged that it would be beneficial to use this typology to assess postgraduate readers' use of digital affordances, to determine the applicability of these e-resources and their functionality to promote academic reading comprehension. The taxonomy consists of eleven resources that support readers' digital reading and

learning (Anderson-Inman 2009). Table 6 provides a list of the e-resources and examples of how each kind of support is manifested within an on-screen reading environment.

<b>E-text resources</b>		
<b>Type</b>	<b>Explanation</b>	<b>Examples</b>
<b>1. Presentational</b>	That enables the reader to adjust the texts in a convenient way, such as background colour, font and size.	Enlarging and minimising texts/text, changing background colour, juxtaposing pages with other pages, graphics in relationship to text.
<b>2. Navigational</b>	That allows the reader to easily move from one part of the document to another part. It also enables readers to use links to move to another webpages and references.	The text itself/the web/existing folders
<b>3. Translational</b>	That provides readers with on-line translation sites to translate and comprehend unfamiliar words, phrases, or even paragraphs.	Google translator/online dictionaries/E-text facilities
<b>4. Explanatory</b>	That aims to clarify specific information such as the where, when and why of a particular concept or/and idea.	Wikipedia
<b>5. Illustrative</b>	That has positive effects and illustrates and explains textual ambiguity.	Videos/power point presentations/ auditory texts such as photographs and supplementary texts
<b>6. Summarising</b>	That provides an overview of the text.	Abstract/tables/graphs
<b>7. Notational</b>	That enables readers to electronically annotate texts.	Highlighting/sticky notes/margin notes/outlining/drawing
<b>8. Collaborative</b>	That facilitates online interactive reading processes between readers.	Blogs/threaded discussion/online chat/email links/podcasts
<b>9. Enrichment</b>	That supports the reader with various information and background knowledge.	Such as text's author, date and place of publication.
<b>10. Instructional</b>	That facilitates readers' text comprehension by providing effective reading instructions.	Tutorials, self-monitoring comprehension questions, impeded study strategies, on-line mentoring, tips for effective reading
<b>11. Evaluation</b>	That assesses learner's learning outcome.	such as questions, quizzes, tests and survey

Table 6: E-text resources examples - technological affordances based on Anderson-Inman (2009)

### **3.9.5 Qualitative: Content and thematic analysis (TA, SR, researcher's FN and Intvw)**

In order to achieve triangulation (mentioned in 3.6) and describe the data qualitatively, the analyses in the current study used instances from readers' think-aloud protocols, SR, the researcher's field notes and interviews to investigate three main themes:

1. The used reading strategies were analysed from three sources of data; think-aloud, SR and researcher's field notes (see 4.2).
2. Triangulation was also achieved by identifying the use of digital affordances by analysing the three sources of data: SR, the researcher's field notes and interviews (see 4.6).
3. Readers' reading challenges and the ways in which they overcame them were analysed through the think-aloud protocols, SR, the researcher's field notes and the interviews (see 4.7).

Thematic and content analysis are the two main approaches that are used in qualitative research for investigating the textual data (Anderson 2007). Distinguishing between thematic and content analysis is difficult as they share most of their features and procedures; and researchers use them interchangeably. According to Joffe and Yardly (2004) and Anderson (2007), content and thematic analysis approaches are descriptive representations of qualitative data that seek to identify, code, categorise, analyse and report patterns within the data. However, content analysis includes a minimal interpretation involving word counts, while thematic analysis moves beyond word count to focus more on the interpretation of ideas (Guest & MacQueen 2008).

### **3.9.6 Using qualitative software**

The major feature of both thematic and content analyses is coding. Therefore, computer assisted qualitative data analysis software (CAQDAS) was used in the current study. NVIVO was chosen to manage the data for several reasons. According to the benefits of NVIVO listed by Cohen et al. (2011) and Baralt (2011), the NVIVO program makes it possible to import data into the program, sort, code data into themes, cluster them into categories and sub-categories, and arrange and store them into key and sub-headings. NVivo was used in this study for four main purposes:

1. Calculating the specific strategies and finding out the frequency of use of each strategy during the actual reading.
2. Comparing and contrasting codes across individuals, groups and time (Bazeley 2013) (see 3.9.8 for further details about constant comparative methods).

3. Collecting information about specific themes and understanding them in depth. The researcher also decided to use NVivo as a means of analysing the data and presenting the results by generating reports and charts. NVivo is used to illustrate all the patterns, examples, trends, exceptions, similarities and differences in data and to show an overall picture.
4. Making it possible to add comments to existing data files, and combine different sorts of data, such as word data, images and excerpts from video and sound recordings, and then code them. Moreover, it makes it possible to create a table to show the hierarchal relationship between the codes visually.

Prior to using NVivo, the video of the TA and audio of the SR and interviews were transcribed and translated. They were then imported to NVivo to generate themes. The Sound Scriber programme was downloaded to transcribe each data sample. It is a software application that allows the playback of audio recordings. It offers a variable speed playback and times pauses and repetition. Although this facilitates the transcribing process, it is still an overwhelming task as a long time and much effort was required to transcribe and translate the sample. The transcribed data was saved in Word documents that were labelled to identify each area, such as the think-aloud, SR, and interviews for each participant. The participants' reading strategies were analysed deductively according to the academic reading strategy scheme (mentioned in 3.9.2, Table 2, p.125) to determine the L2 academic reading strategies used by postgraduate students when reading L2 academic research articles in their field of study. Then, readers' reading strategies were also analysed inductively from the transcribed data (Appendices J.8 & J.9 represent samples of data stored, organised and analysed via NVivo).

The coding and analysis of the data sample proceeded in three stages, initial coding, axial coding and framing categories and sub-categories. Firstly, during the initial coding, the researcher went through the subsets of data lines several times. The researcher jotted down notes, comments and queries in the margins. Then, the researcher drew up tables consisting of two columns; transcripts and themes. The researcher divided the transcripts into separate extracts, included them in a table, and gave each extract a theme, for example translating, initial reading, careful reading, reading the abstract, dealing with the references section and reading as a complex process. The themes were extracted from the data and the participants' replies. They are all based on words that were articulated by the participants themselves. The researcher then assigned codes to specific actions, behaviours and topics based on the research framework and previous relevant research, for example, codes have

been assigned for the problem-solving reading strategies, (PROB). The codes were read several times and refined to ensure appropriate classification. The researcher coded the themes and then refined them and collapsed them according to the similarities between them.

Secondly, axial coding, in which patterns in the data are identified by comparing codes within and across participants, was used to formulate and name categories, and to make connections between these categories. NVivo generates an infinite number of codes. The researcher went through all the data and the codes, reduced the number of codes and identified patterns across all the participants. Following this, the data was checked and evaluated by colleagues to minimise bias and ensure triangulation before being explained and interpreted in detail. Thirdly, the categories and the sub-categories were applied as a framework to describe each case.

### **3.9.7 Quantitative: Descriptive analysis from qualitative data: (TA, SR and/or Intw)**

Although the current research is primarily qualitative in nature (see 3.2 for qualitative approach), and reliability is not a concern (see 3.5 for research trustworthiness), quantitative analysis of the occurrence of the strategies has been conducted from the qualitative data in order to reveal the prevalence and popularity of each strategy. The researcher used descriptive statistics (Cohen et al. 2011) to describe and present the data from two angles:

#### **1. Frequencies of the employed strategies/e-resources**

First, frequencies were presented interchangeably in terms of the number of instances, percentages and means in order to reveal the quantity of instances in which the various sorts of reading strategy categories, sub-strategies, e-text resources, and processes were employed. The frequency of use of the strategy categories, sub-strategies, e-resources and reading processes, across the whole data base, are based on the SR data only, as this presented the richest data and thus allowed the most accurate quantitative view by avoiding replication with similar data from other sources. The researcher tabulated all instances of reading strategy use from the two groups of readers and calculated the percentage of use for the different types of on-screen reading strategy categories (see 4.2), reading sub-strategies (see 4.2.1, 4.2.2, 4.2.3 & 4.2.4), reading processes (see 4.5), and e-text resources (see 4.6). Similarly, the frequency of print-based reading strategy categories and sub-strategies was also determined (see 5.2). A comparison between on-screen and print-based reading regarding reading strategy categories, sub-strategies and processes was presented quantitatively in 5.4. The analysis included tables and figures to visually portray the number of instances, percentages, or means with which various types of strategy, sub-strategies, and processes were used.

## **2. Number of readers who employed sub-strategies/e-resources**

Quantitative descriptive analysis was also used to identify the number of readers who employed these sub-strategies and e-resources. In order to determine the quantity of participants who employed specific sorts of strategies and e-resources, a nominal scale (Cohen et al. 2011) was chosen to denote categories, and two numbers were selected for the current study (0 and 1), with 1 meaning that the reader employed a given strategy and 0 meaning that the reader did not. The data from each participant was analysed individually using NVivo, and the results are presented in tables consisting of a row listing the reading strategies and a column listing the names of the participants, followed by columns presenting data, including whether or not they employed a given strategy (see Appendix J.10 for Excel data sample). The researcher changed the number of instances of participants employing a specific strategy to 1 or 0, depending on the findings. In this way, the researcher achieved results presenting the most and the least popular reading strategies amongst the participants.

For the purpose of clear presentation, the actual numbers of readers who employed each strategy and e-resources are presented in the form of percentages, which were identified by dividing the number of readers who used specific strategies by the total number of participants and multiplying the total by 100. The number of participants who employed each of the sub-strategies is based on data from the interviews, SR, and TA sessions in which the readers were either observed, or reported using any of these strategies or/and digital affordances.

### **3.9.8 Constant comparative methods (CCM)**

The current study also adopted a constant comparative method (CCM) to achieve the minor objectives of the research (mentioned in 1.4). This is based on a comparison and contrast between the data collected from different groups, by different methods, or between actual data and the ideal (Boeije 2002 and Leong, Joseph & Boulay 2010). In the current study, the (CCM) was used to:

1. Compare and contrast on-screen and print based reading.
2. Compare and contrast data, which is collected from the Master's participants in the two different phases.
3. Compare and contrast data collected from participants from different disciplines.
4. Provide a comparison between the data, which was collected from the PhD and Master's participants in the second phase.

5. The results of the current study are also compared with the results of previous studies that have examined the reading practices of different groups of readers.

### **3.9.9 Case studies**

In the current study, an attempt has been made to explore the factors that might affect readers' L2 on-screen academic reading practices, such as the effects of field of study or individual differences.

1. Three readers from different disciplines have been randomly chosen to highlight the differences and similarities between the reading practices of students from different disciplines. A description of the readers' reported reading practices, including reading preferences, challenges, strategies and the use of e-resources has been provided (see 6.5.1). The first reader is DAL, a participant from the School of Computer Science, the second reader is HEN from the School of Engineering, and the third reader is GAD, a student of Social Science (see Appendix A for the participants' demographic details).
2. In order to determine the effects of individual differences and diverse academic reading styles on readers' reading practices and to eliminate the possibility of confusing results that might occur due to discipline-specific effects on reading, the researcher randomly selected two readers studying the same major. Thus, a comparison between two readers; ALA and SAR, Computer Science PhD students has been conducted (see 6.5.2).

In summary, this chapter has set out the design and the methodology underpinning this study. It has scrutinised the research methods and important requirements of the study, in order to develop a methodology, and to justify the research design. A discussion of the qualitative approach was also presented, in conjunction with its contributions to the current study. The chapter then outlined the case study approach selected, explored its advantages and disadvantages and assessed its appropriateness for meeting the objectives of this study, which is to arrive at an understanding of academic readers' interactions with on-screen texts. This was followed by sections presenting the research participants, trustworthiness and triangulation of the data. The chapter then presented in detail the research methods employed, followed by the data collection procedure and techniques used to analyse the raw data.

The following chapter exemplifies, explains and presents detailed data illustrating the research findings from both quantitative and qualitative angles. The chapter examines the findings that have led to the suggestion of new models of interacting with on-screen text. It presents on-screen reading processes, reading strategy categories, sub-strategies, use of e-resources, hierarchical interaction with on-screen text and associated strategies.

# Chapter 4: Towards models of on-screen academic reading comprehension strategies

## 4.1 Introduction: Synthesis of overall findings

This chapter presents models of on-screen academic reading interaction and the data from which they are derived. These models constitute the proposed digital academic strategy literacy (DASL) and answer the research questions outlined in 2.7.

The chapter first of all, is concerned with the strategic nature of interaction with on-screen academic text (see 4.2). Analysis of the data suggests a new on-screen reading strategy scheme, which combines the original scheme presented in 3.9.2 and newly identified strategies. In this chapter, a new scheme for on-screen reading is presented and justified by explanations and examples. The section describes in-depth the reading strategy categories and the sub-strategies that the readers employed during on-screen reading and presents examples from four different sources of data to achieve triangulation: think-aloud protocols (TA), stimulated recalls (SR), researcher's field notes (FN) and interviews. The section then presents the different types of categories and sub-strategies used and compares the frequency of use of each of these in detail. A comparison is then drawn between the most and least used sub-strategies by analysing the number of participants who used each strategy during the reading task.

Section 4.3 presents the nature of on-screen reading comprehension. It first suggests a model (see Figure 9, p.163) that illustrates the hierarchical strategic levels of on-screen reading comprehension; text, section, paragraph; and sentence, phrase and word levels. It then proposes and illustrates a model (see Figure 10, p.173) that describes the patterns of on-screen reading interaction. After that, the chapter presents and exemplifies a suggested model (see Figure 11, p.175) that describes the associated reading sub-strategies in 4.4. Section 4.5 explores central tenets, presenting data which explains the on-screen reading processes. It presents detailed data to compare and contrast the top-down and the bottom-up reading processes used by the readers in order to interact with, read and comprehend on-screen text. Section 4.6 discusses the various types of digital affordances in detail and exemplifies their use by providing examples from the participants' actual reading tasks. It also presents the frequency (number of instances) of use of these e-resources and the number of readers who used them during on-screen reading. Based on the data relating to the participants' use of e-

resources while reading on-screen in this study, Anderson-Inman's (2004) original e-resources typology (mentioned in 3.9.4) has been modified. By doing this, the present study develops an overview model (see Figure 14, p.179) that is thought to represent the e-resources that are utilised by readers in an academic digital reading context. The TAs, SRs, researcher's FNs and interviews suggested that on-screen readers can utilise a number of effective e-text resources to enhance their reading comprehension. However, it was found that the readers under investigation did not employ these e-resources extensively for several reasons (see 6.2.4 for further discussion). The chapter in 4.7 then brings to light the challenges that readers experienced with regard to on-screen reading comprehension.

In the following sections, the findings are presented using data from TA, SR, and interviews. Each section begins by presenting the main findings followed by a detailed analysis. The next section presents on-screen functional, reading strategy categories and sub-strategies with examples to demonstrate their use by the participants.

## **4.2 On-screen functional reading comprehension strategy categories and sub-strategies**

The study found that digital academic strategy literacy (DASL); including on-screen reading has a specific strategic nature. Results demonstrate that reading and interaction with on-screen text requires the use of four main functional reading strategies in order to achieve comprehension. The data, which was analysed and coded according to three categories; PROB, GLOB and CRT, has suggested that the previous reading strategy scheme proposed in 3.9.2, Table 2, p.125, which drew on existing research in the area (presented in 2.5.1), does not fully represent the on-screen reading comprehension strategies identified in this study. Thus, the data has suggested a new on-screen reading strategy scheme in Table 7. It is divided into four strategy types, namely problem-solving reading strategies, support reading strategies, global reading strategies and critical reading strategies. Each column presents sub-reading comprehension strategies. The underlined text indicates recurrent sub-strategies and the bold text equals the newly identified sub-strategies (see Appendix I, Table 16, p.338 for the names, categorisation, definitions and examples of these sub-strategies).

(Continued overleaf)

<b>On-screen reading strategy scheme (ORSSC)</b>			
<b>1. Problem-solving reading strategies (PROB)</b>	<b>2. Support reading strategies (SUP)</b>	<b>3. Global reading strategies (GLOB)</b>	<b>4. Critical reading strategies (CRT)</b>
<ol style="list-style-type: none"> <li>1. Changing reading rate</li> <li>2. Re-reading</li> <li>3. Using context</li> <li>4. Translating using hard copy dictionaries</li> <li>5. Translating electronically</li> <li>6. <b>Pausing</b></li> <li>7. <b>Thinking</b></li> <li>8. <b>Pointing</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Marking the text</li> <li>2. Making a summary</li> <li>3. Taking notes</li> <li>4. Reading aloud</li> <li>5. Formulating questions</li> <li>6. Paraphrasing</li> <li>7. Reviewing</li> <li>8. <b>Vocalising electronically</b></li> <li>9. <b>Confirming</b></li> <li>10. <b>Pausing</b></li> <li>11. <b>Thinking</b></li> <li>12. <b>Pointing</b></li> <li>13. <b>Continuing to read</b></li> <li>14. <b>Mentally visualising text content</b></li> <li>15. <b>Connecting text content</b></li> <li>16. <b>Using computer functions</b></li> </ol>	<ol style="list-style-type: none"> <li>1. Using visual aids</li> <li>2. Previewing</li> <li>3. Locating key words</li> <li>4. Identifying main idea</li> <li>5. Attending selectively</li> <li>6. Skipping</li> <li>7. Using background knowledge</li> <li>8. Anticipating</li> <li>9. Planning</li> <li>10. Having a purpose</li> <li>11. Mind mapping ideas</li> <li>12. Scanning</li> <li>13. <b>Pausing</b></li> <li>14. <b>Thinking</b></li> <li>15. <b>Using text references</b></li> <li>16. <b>Connecting ideas</b></li> </ol>	<ol style="list-style-type: none"> <li>1. <b>Evaluating the information</b></li> <li>2. <b>Evaluating the source of the information</b></li> <li>3. <b>Evaluating the language</b></li> <li>4. <b>Evaluating the style</b></li> </ol>

Table 7: Modified on-screen reading strategy scheme (ORSSC) resulting from the present study

Closer examination of the type and frequency of all the reading strategy categories and sub-reading strategies reveals that on-screen academic reading for comprehension requires various sorts of strategies. During on-screen reading, readers utilised diverse functional types of strategies to assist comprehension; either to solve a problem, support their reading comprehension, interact with the text globally or to critically evaluate the content. However, the frequency with which these strategies were utilised during the readers' on-screen L2 academic reading varies significantly (see the following sections for further detail and 6.2.1 for a discussion).

The analysis also reveals that although readers utilised various sorts of strategies during their on-screen reading, their overall utilisation of each strategy was low, i.e. most strategies were used with low frequency.

Figure 4 presents the frequency with which different reading strategies were used to engage with on-screen texts. It demonstrates that a range of strategies were used to solve comprehension problems and to support reading comprehension. Readers also frequently employed background knowledge to globally assist comprehension. However, they rarely interacted deeply with the text on-screen and read critically (see 5.4 to compare with print-based reading comprehension strategies).

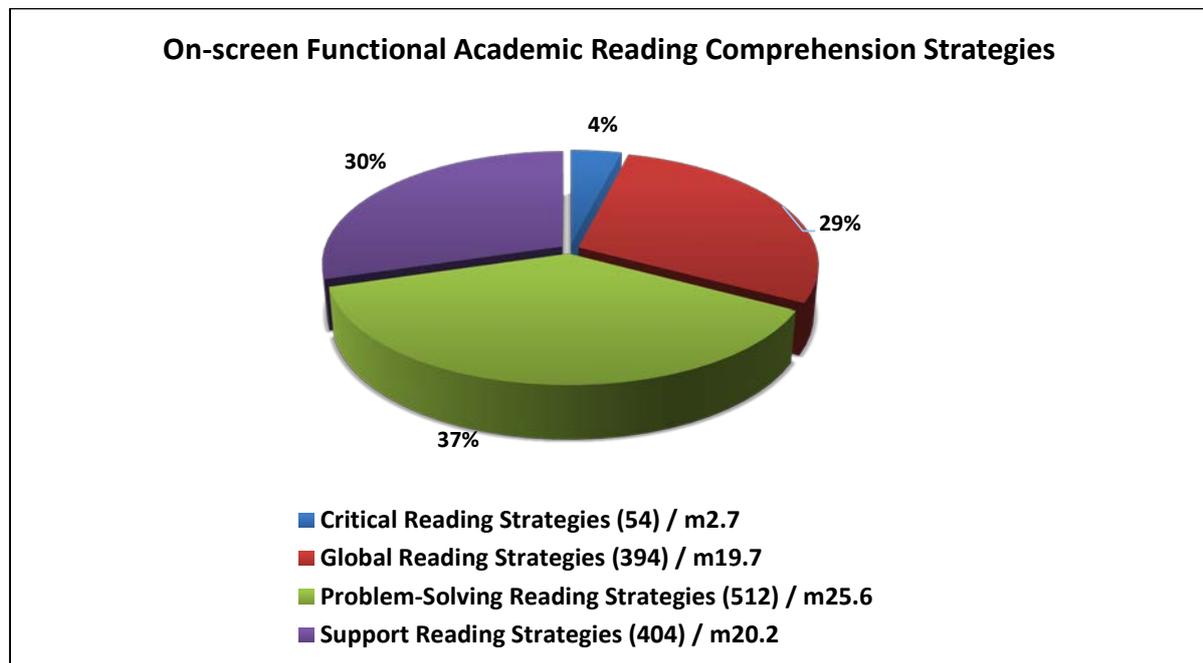


Figure 4: The frequency (number of overall instances) of the on-screen academic functional reading strategies employed by participants (n = 20)

As evidenced, the most frequently employed strategy was that of problem-solving (37%). For example, all readers often translated, changed their reading speed, paused, pointed and re-read sections of text. Supportive reading strategies were also frequently employed (30%). For example, all readers vocalised, annotated and confirmed as they went along. The third most frequently employed strategy was the global reading strategy (29%). For example, all readers skipped, used background knowledge, previewed and identified main ideas. Critical reading strategies, by contrast, were used much less frequently (4%) (see 6.2.1 for discussion). The following section illustrates in detail the frequency with which the sub-strategies of each category were used by on-screen readers followed by examples of readers' employment of the sub-reading strategies.

#### **4.2.1 On-screen PROB sub-strategies**

The most frequently employed strategy was problem-solving. It is interesting to note that the most common on-screen PROB reading comprehension sub-strategies are re-reading, translating electronically, pausing, thinking, pointing and ignoring difficult sections. On the other hand, the least employed PROB sub-strategies are separating sections, connecting ideas, using context and changing reading rates (see 6.2.1 for full discussion and reasoning). A list of these strategies is shown below, together with the number of instances of occurrence within the data. For further clarification, these results are illustrated graphically in Figure 5 to present in percentage the frequency of each of the utilised PROB sub-strategies during the on-screen reading task.

1. Changing reading rate: 32 instances
2. Re-reading: 81 instances
3. Using context: 15 instances
4. Thinking: 45 instances
5. Pointing: 42 instances
6. Pausing: 41 instances
7. Ignoring difficult sections: 64 instances
8. Translating using hard copy dictionaries: 0 instances
9. Translating electronically: 59 instances
10. Parsing sentences: 0 instances
11. separating text content: 0 instances
12. Connecting text content: 10 instances

(Continued overleaf)

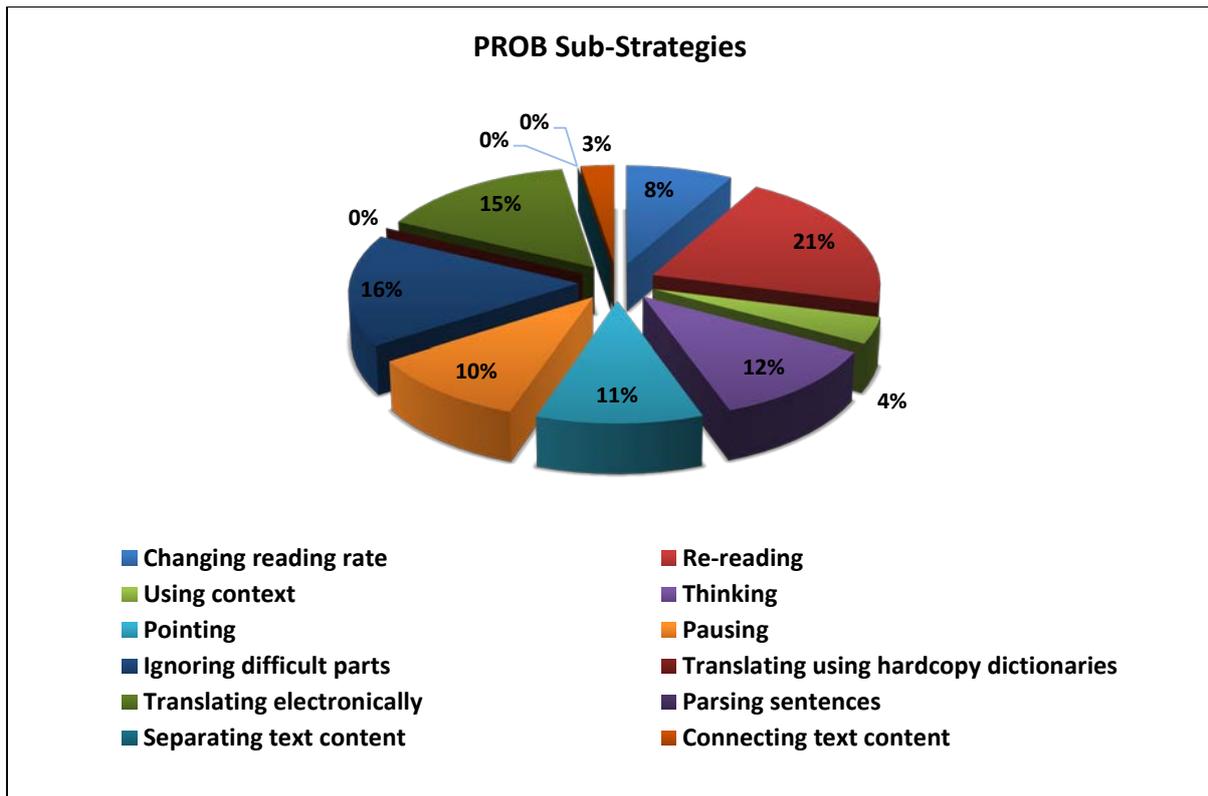


Figure 5: The frequency of the PROB sub-strategies employed (on-screen)

Each of these strategies is exemplified in the following sections by presenting quotes from the think-aloud, stimulated recalls and field notes extracts (see 6.2.1 for further discussion). In terms of distribution of these sub-strategies, the number of readers (in percentage) who employed them is identified below.

### 1. Changing reading rate

40% of the readers were observed reducing their reading speed in order to comprehend key and relevant information that they could not comprehend during the first reading. For example, AFR in the following quotes declared that she decreased her reading speed when she came across key ideas in the text in order to comprehend them,

*'Actually here I was slowing my reading because these are the key ideas in the paper. Here I did not understand what the oriented mobility assessment is (.) I needed to understand them. Also while I am reading actually I am thinking about the information and I am imagining the whole scenario, the study of the paper' (SR)*

### 2. Re-reading

100% of readers in the present study used the re-reading strategy, in which the readers read a specific paragraph, sentence and/or words several times in order to comprehend challenging information as exemplified by MAH who said,

*'I re-read these sentences several times (.) they include details about classroom management' (Ph2/SR)*

### **3. Using context**

On the other hand, only 30% of the readers used context, in which they examine the sentence in which the word occurs, the previous sentences or the following one in order to comprehend the unfamiliar word. For instance, AFR reported that she was trying to read the sentences associated with the unknown word in order to understand it.

*'I was trying to understand the word consistently from the context. I was thinking what does this word mean here' (TA)*

### **4. Pausing and thinking**

100% of the readers used the pausing strategy to solve a comprehension problem, as well as changing their reading rate or moving to reading and thinking as exemplified by RSH who said that she pauses to think about the content if she could not understand a specific idea,

*'I stop my reading and focus on specific words and think about the meaning and try to understand the idea and the information' (SR)*

### **5. Pointing**

Similarly, 100% of the readers were pointing towards specific sentences and/or words using an object or the cursor during their reading in order to track their reading whenever they moved to use other strategies while reading, such as translating or writing notes. For instance, LAY said,

*'I started to lose concentration and I was trying hard to focus and understand. The pen helps me to follow my reading and focus' (SR)*

### **6. Ignoring difficult sections**

Furthermore, 90% of the readers ignored difficult sections, sentences and/or paragraphs that they could not understand and they sometimes kept reading the articles even if they could not fully understand the content when they read it for the first time. None of the readers during on-screen reading returned back to read the ignored parts. When they realised it was complicated or had detailed content, they ignored it and moved on to the next section, as exemplified by MAH who reported that she ignored complicated sections when she could not understand their ideas,

*'Here I could not understand the idea (.) I re-read the sentences several times (.) also I re-read the whole paragraph from its beginning but I could not understand what does he want to say (.) actually I ignored it' (Ph2/SR)*

Similarly, SAJ said,

*'I did not read this part ahh if I faced difficult sections while I am reading on-screen and I don't need them I don't even try to understand them at all (.) I ignore them (.) if they are not relevant to my key points I don't confuse myself'* (Ph2/SR)

Also, AML declared,

*'Sometimes when I don't understand the abstract and I still interested in the paper I keep reading it because I sometimes understand when I complete reading'* (Intvw)

### **7. Translating electronically**

80% of the readers electronically translated unknown words during on-screen reading. Readers used Google translator, online dictionaries and/or translating websites in order to comprehend unfamiliar words. For instance, SAJ was observed translating unfamiliar words during on-screen reading using Google translator,

*'hum I cannot understand this sentence (00:23) I will see [she highlights the sentences, right clicks, copies the sentence, opens Google translator, pastes the sentence] ° directly applicable studies° [she reads the meaning] it is still not clear'* (Ph1/TA)

### **8. Connecting text content**

Only 25% of readers made connections between text content while reading in order to overcome comprehension challenges. For instance, AML in the following quotes had confusing information, and had to make connections between different parts of the text for clarification and comprehension purposes.

*'Because I needed to remember the first one (.) ahh just to connect the ideas of the first diagram and the second one (.) they seemed confusing at the beginning because the first one was types of information and the second one was about types of information system (.) I needed to check this information (.) so I returned back to the first one'* (Ph1/SR)

Surprisingly, the strategies of separating text content, parsing sentences, and utilising hardcopies of dictionaries were never used during on-screen reading.

#### **4.2.2 On-screen SUP sub-strategies**

Secondly, support sub-strategies were also employed during on-screen reading. The data shows that the most utilised SUP sub-strategies were marking text, pausing, thinking, pointing and using computer functions. In contrast, the least employed SUP sub-strategies were summarising,

vocalising electronically, mentally visualising text content, reviewing, connecting text content and paraphrasing (see 6.2.1 for full discussion and reasoning). A list of these sub-strategies is shown below, together with the number of instances of occurrence within the data. For further clarification, these results are illustrated graphically in Figure 6, which presents in percentage the frequency of each of the utilised SUP sub-strategies during the on-screen reading task.

1. Marking the text: 89 instances
2. Making summary: 9 instances
3. Taking notes: 36 instances
4. Reading aloud: 59 instances
5. Vocalising electronically: 10 instances
6. Formulating questions: 11 instances
7. Paraphrasing: 13 instances
8. Confirming: 28 instances
9. Connecting text content: 21 instances
10. Pausing: 42 instances
11. Reviewing: 11 instances
12. Pointing: 73 instances
13. Thinking: 46 instances
14. Using computer functions: 87 instances
15. Mentally visualising text content: 2 instances
16. Continuing to read: 25 instances

(Continued overleaf)

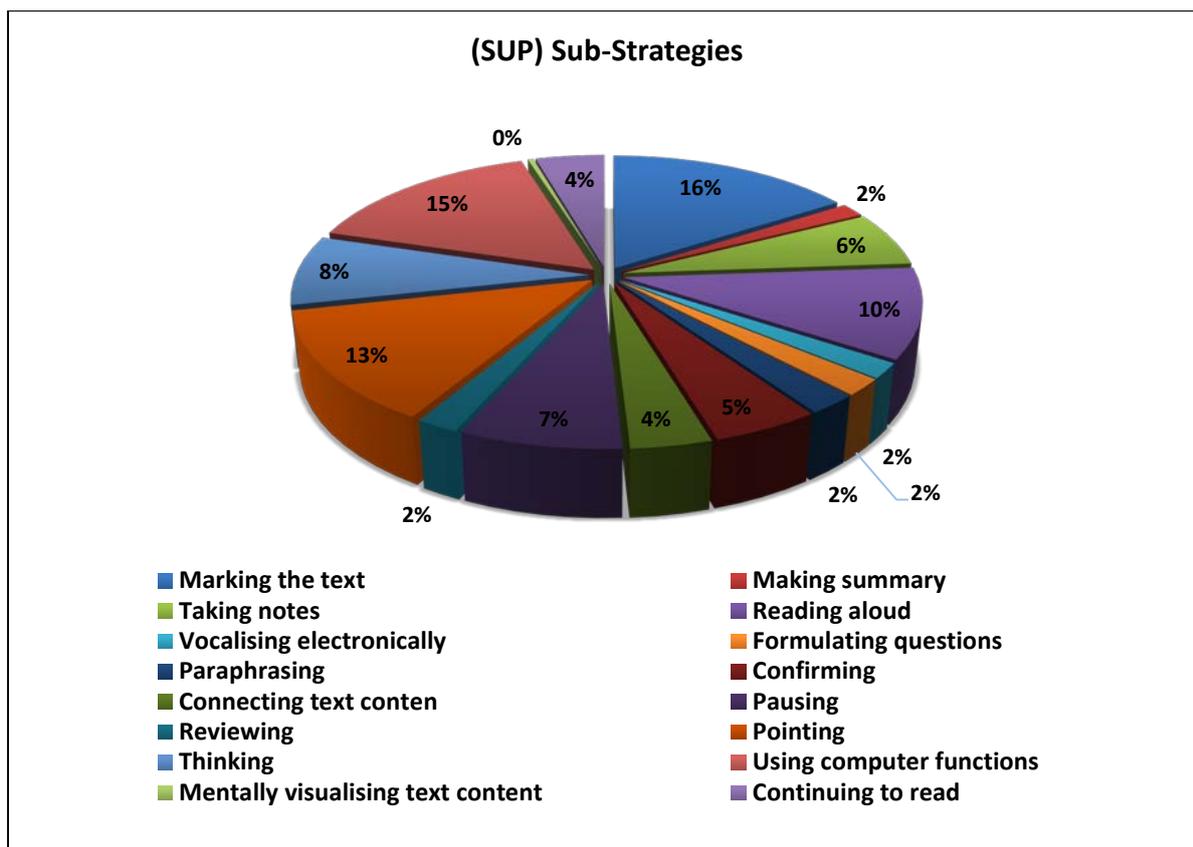


Figure 6: The frequency of the SUP sub-strategies employed (on-screen)

Each of these strategies is exemplified in the following sections by presenting quotes from the think-aloud, stimulated recalls and field notes extracts (see 6.2.1 for full discussion). In terms of distribution of these sub-strategies, the number of readers (in percentage) who employed them is identified below.

### 1. Marking the text

The analysis of the data shows that 100% of the readers were marking the most important parts of the text while reading on-screen in order to increase their focus and comprehension. However, they were only using the digital highlighter to mark a specific paragraph, sentence and/or word while reading in order to support their reading comprehension and none were underlining or scribbling on the text. For instance, SAJ was observed that she highlights the most important parts of the text, such as questions in order to concentrate on them,

*‘Ok here they started the section with a question (.) I highlighted the question to focus on and search for the answer of this question’ (Ph2/SR)*

### 2. Making a summary

Readers made summaries of the content infrequently as they read the academic text. Only 54% of the readers made a summary in order to enhance their reading and writing process and to aid future

re-reading of the same article. For instance, AML summarised important information relating to her academic reading purpose in a separate document for reading, writing and reminding purposes, (see Picture 3 - Appendix K.3 for further clarification)

*'This information is very important I may use it in my assignments (.) I wrote summary for them so I can remember this information and return back to this article'* (Ph2/SR)

### 3. Taking notes

100% of the readers also took notes while reading, either manually using a paper notebook or by typing in a Word document or on the article itself using specific software, such as Mendeley, Endnote or Adobe Acrobat X Pro. Readers took notes and briefly re-wrote the most important information for later reference and guidance. For example, AFR said that she wrote notes about important information related to her reading purpose, (see Picture 4 - Appendix K.1)

*'Also here I had to write important information about the duration of the training eight weeks'* (SR)

Similarly, AML illustrated that writing notes about the paper helped her re-reading to be more guided and saved time,

*'Ok here I wrote down the abbreviation of reference ref and this note here to write the title of the paper or the link so when I return to this document later on I can go back and re-read the information from the original paper itself (.) ahh also I wrote here the kind of information for example here I wrote case study (.) sometimes I write background or definitions to guide me when I re-read the paper and it also saves my time'* (Ph2/SR)

### 4. Reading aloud

90% of the readers vocalised by articulating specific paragraphs, sentences and/or words in order to hear themselves. This seemed to support and enhance their reading comprehension as in AFR's reading,

*'\*\*\*\*\* < elderly = [she writes notes] alright \*\*\*\*\* = (00:06) \*\*\*\*\* there is no difference'* (TA)

Also, DAL mentioned that if she wants to support her comprehension of specific information, she reads out-loud,

*'If I feel the sentence is useful and related to my project (.) I re-read it aloud and highlight it and return to my writing and look at where it fits in and then paraphrase it'* (Intvw)

MAJ declared that she reads out-loud in order to concentrate,

*'Usually when I read and I want to concentrate I vocalize. It helps me to understand better than only reading silently'* (SR)

### **5. Vocalising electronically**

Only 20% of the readers 'electronically' vocalised specific sentences, phrases, and/or words while reading by inserting words, sentences or/and paragraphs in Google voice to be read electronically in order to support their reading comprehension. In one interesting instance SAJ stated that she employs Google voice to read specific sections or paragraphs for her in order to support her reading comprehension,

*'when the computer read it for me it became easier than I read it (.) actually sometimes I do this when I read now the medical articles this makes me understand better (.) this happen in the first stage when I read and skim and scan but when I start the stage to take notes I print I write down on the paper itself (.) usually I listen to the text when I lose my concentration'* (Ph1/SR)

Also, GAD declared that she sometimes had Google voice articulate specific words from the reading text,

*'It was hard for me to pronounce it as well. I used Google to get the meaning of the word and listen to its pronunciation'* (SR)

### **6. Formulating questions**

Formulating questions in which readers question themselves about the content of the text and specific information included in the reading text, was also a less frequently used strategy, with only 45% of readers applying it to enhance their reading comprehension. For instance, MAJ questioned the text in several instances in order to enhance her search for the right answers and comprehension,

*'How did he decide to test the hypothesis? [She scrolls the page up] (00:31) [she scrolls the page down] what made the eleventh hypotheses none? < What is the reason that he repeated among all these factors? = [she scrolls the page down] >'*  
(TA)

She then illustrated that by doing so she becomes more motivated to find answers for her questions in the reading text,

*'I asked these questions because they motive me to try finding where are the answers for these questions (.) ahh I makes it easier for me to follow and comprehend the text'* (SR)

Similarly, AFR was questioning her self during reading,

*'(00:12) ok when? These test \*\*\* produced? \*\*\* [she writes notes]' (TA)*

### **7. Paraphrasing**

20% of the readers were writing down the information that they read using synonyms and changing the structure of the sentences from the original text in order to keep a record of what they had read and/or to save time in later reading and writing. For example MAH stated,

*'Here I read these sentences I needed to include them in my document (.) I wrote the beginning of the sentence but then I needed to check the idea (.) I returned to the article I re-read the idea and then typed them in the Word (.) I needed to check and remember the idea before paraphrasing and typing it ... .. I do this because I want to save my time when I start writing my assignment' (Ph2/SR)*

### **8. Confirming**

75% of the readers also regularly confirmed their understanding by vocalising and uttering specific words or phrases while reading in order to emphasise and consequently support their comprehension, such as saying 'ok', 'all right' or re-stating specific information in their own words. For instance, AFR uttered,

*'Ahh ok °°\*\*\*°° ok and then [she moves the page down] °°\*\*\*°° all right °°\*\*\*°° so they took people who are elderly and from the community' (HS/TA)*

### **9. Connecting text content**

Connecting ideas and information strategies between different sections of text while reading was also frequently employed by the readers (60%) in order to enhance reading comprehension of specific information. For example, AML explained that she was connecting worded information with information in a diagram in order to support her comprehension,

*'Actually here I saw the diagram first and then I needed to re-read what is written before it (.) I knew that it is about another approach of information system (.) ahh I did not read about it in details I only needed to know what it is (.) then I returned back to the diagram' (Ph1/SR)*

### **10. Pausing and thinking**

Moreover, 100% of the readers stopped their reading for a few seconds, or sometimes for a minute or more, at specific sentences or paragraphs in order to think about the content. For instance, LAM

was observed stopping for (01:35), (00:50), (00:44), (00:37) and then for (00:12) while reading a specific paragraph in order to think about the information.

*'I highlight here [she adjusts the screen] (01:35) [she scrolls the page down] (00:50) [she scrolls the page down] (00:44) [she scrolls the page down] (00:37) [she scrolls the page down] (00:12)' (Ph2/TA)*

In addition to pausing, 80% of the readers spent time thinking about specific phrases, words, or sentences in their head to support and enhance their understanding during the reading process. For instance, SAJ said that she stops to think,

*'I needed to think about these two sentences (.) I was analysing the words and trying to think about their meaning in the context' (Ph2/TA)*

Also, MAH was observed pausing frequently to think while reading,

*'She is pausing for a while' (Ph1/FN)*

### **11. Reviewing**

The data also shows that reviewing was a less frequently used strategy, exemplified in only 30% of the readers. This involved re-reading specific sections of the text after finishing a first reading in order to check previous information and/or check comprehension. An example is AFR who revised the article after reading it in order to support her comprehension of the entire text,

*'I was revising the information that I read and I was revising my understanding just to be sure about all the information in the text' (SR)*

Also SAJ stated,

*'I returned to the beginning of the paragraph because I wanted to check my understanding of the main idea of this paragraph' (Ph2/SR)*

### **12. Pointing**

All readers were inclined to point towards specific written sentences while reading to support their reading fluency and to keep track of where they are in the text. For instance, AML was observed using the cursor on-screen to track her reading in order to support her reading fluency.

*'<I need the title of the paper or the link to return back to it [she scrolls the page up/ moves the cursor > (00:04) [she highlights the title of the paper/ moves the cursor >' (Ph2/TA)*

In the same manner, SAJ was observed supporting her reading fluency by moving the cursor on the sentences,

*'She moves the cursor on the sentences while she is reading' (FN) and 'She points with her finger to the sentences and follows the sentences using her finger'*

### **13. Using computer functions**

Similarly, 100% of the readers were observed using e-resources to support their reading comprehension. See 4.6 for details about readers' use of e-resources while reading on-screen.

### **14. Mentally visualising text content**

However, only 15% of the readers formed a mind map about the content of the text; that is they drew an imaginary picture of the text's content and tried to visualise specific parts of the text, such as the methods section, in order to enhance their overall comprehension of the text. For example, REE stated that she was attempting to visualise the content of a text by making use of the quotes embedded in the text in order to enhance her overall comprehension,

*'I am reading this ahh what the researcher said to the patient here he wrote it as a quote is very important about their recovery process (.) also here is really good way that the researcher tried not to give the patient a hope that they will get full recovery to avoid any depression (.) also to avoid any emotional effect on the result this is good' (Ph2/TA)*

She explained,

*'Actually I have read these information and I was imagining the whole situation because of the style of the writer here he used a quotes of what he said to the patients (.) it is really exciting' (Ph2/SR)*

Similarly, MAJ illustrated,

*'I drew and I placed the information into points in a graph (.) it helps me to understand the information and remember it easily later on' (SR)*

### **15. Continuing to read**

20% of the readers stated that they sometimes continue their reading of a text even if they cannot understand every section. They declared that they use this technique as they increase their background knowledge about the topic, that they understand the text more fully as they go through and by the end of their reading they can comprehend the text. For instance, MAH declared,

*'Sometimes when I don't understand the abstract and I still interested in the paper I keep reading it because sometimes I understand when I complete reading but most of the time I lose my interest when I feel the article is too complicated from the beginning' (Ph1/SR)*

### 4.2.3 On-screen GLOB sub-strategies

The data from this study shows that the participants employed several kinds of global (GLOB) reading sub-strategies. It is interesting to note that the most common on-screen GLOB sub-strategies were previewing, identifying main ideas, attending selectively, skipping and having a purpose during reading on-screen. On the other hand, there were a number of sub-strategies that were rarely used during on-screen reading, such as connecting between ideas and planning (see 6.2.1 for full discussion and reasoning). A list of these sub-strategies is shown below, together with the number of instances of occurrence within the data. For further clarification, these results are illustrated graphically in Figure 7, which presents in percentage the frequency of each of the utilised GLOB sub-strategies during the on-screen reading task.

1. Using visual aids: 19 instances
2. Previewing: 42 instances
3. Locating key words: 18 instances
4. Identifying main ideas: 54 instances
5. Attending selectively: 51 instances
6. Skipping: 54 instances
7. Using background knowledge: 29 instances
8. Anticipating: 7 instances
9. Planning: 12 instances
10. Having a purpose: 57 instances
11. Thinking: 24 instances
12. Scanning: 23 instances
13. Using text references: 21 instances
14. Connecting ideas: 12 instances
15. Pausing: 20 instances

(Continued overleaf)

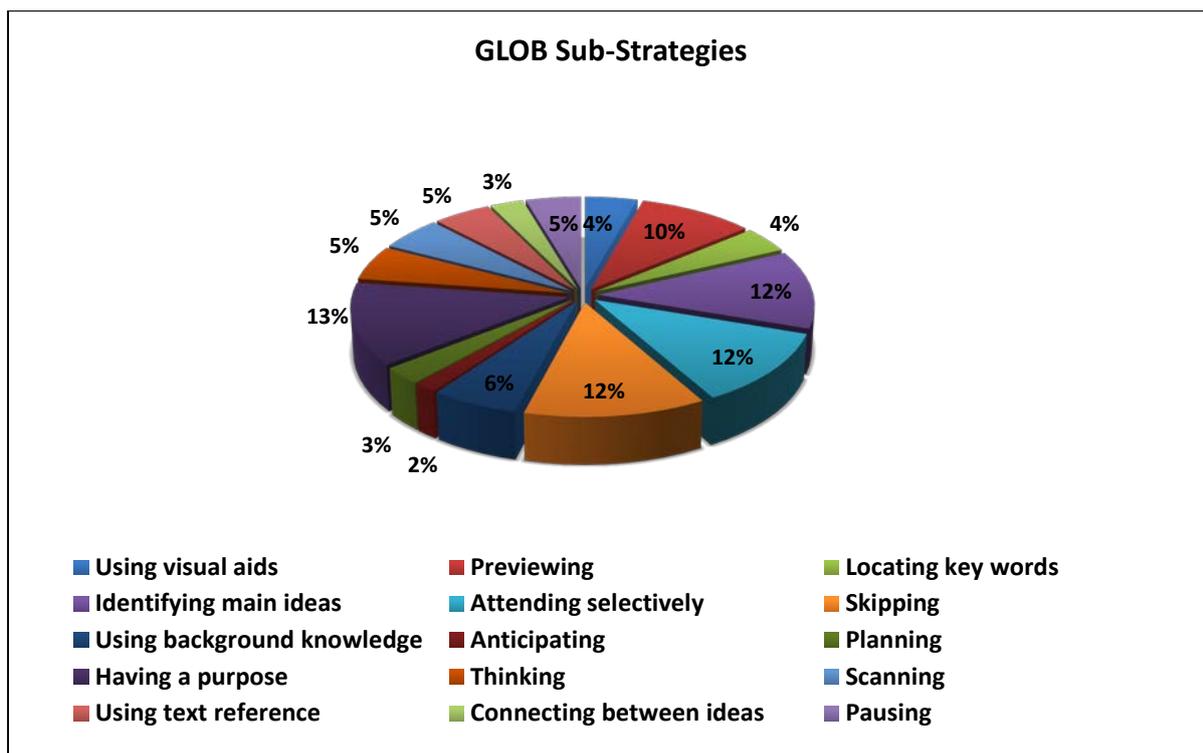


Figure 7: The frequency of the GLOB sub-strategies employed (on-screen)

Each of these strategies is exemplified in the following sections by presenting quotes from the think-aloud, stimulated recalls and field notes extracts (see 6.2.1 for full discussion). In terms of distribution of these sub-strategies, the number of readers (in percentage) who employed them is identified below.

### 1. Using visual aids

Firstly, only 35% of the readers were using visual aids such as interpreting graphs, tables and figures to enhance their comprehension before reading the words. For instance, FAT said,

*‘They referred to a diagram and I moved the page down and here first I read the caption under the table and then I read the table, all these numbers (.). After that I moved the page down and read this diagram’ (SR)*

### 2. Previewing

70% of the readers were employing a previewing strategy in which they initially read the text by checking its title, sub-titles, sections and main ideas in order to obtain a general idea about the text before actual reading. For instance, REE declared that during her first reading of the text, she previews the main sections and main ideas of the article before reading in detail, and this usually occurs on-screen,

*'This is my first reading of this paper (.) I am only checking the information and the different parts of the study (.) I don't read in details anything (.) I only get the main idea of each part and then when I re-read these parts for the second time I focus on the details'* (Ph2/SR)

### **3. Locating key words**

In addition, 40% of the readers located key words that represented the most important ideas of a text in order to speed up their reading comprehension, identify the main idea from each paragraph and increase their focus on specific paragraphs related to their reading objectives. For instance, REE commented that finding the key words in a paragraph guides her to locate the main idea and the most relevant parts of the text for her academic purposes,

*'Ok here because this paragraph contained key words related to my focus (.) such as the acupuncture and the slimming effect (.) ahh I was focusing here and thinking about the information (.) these information are very important (.) ahh the first part was more literature review while this part here is very important information (.) ahh I was reading very slowly and I was trying to understand every single word'* (Ph1/SR)

On the other hand, there were a number of sub-strategies that were rarely used during on-screen reading. Some examples are detailed below.

### **4. Identifying main ideas**

Furthermore, 100% of readers were looking for main ideas and avoided reading details while reading on-screen in order to speed up their reading, assess the relevance of the text and meet their objectives. For example, AML mentioned that at first when she reads on-screen, she only attempts to identify the main ideas in each paragraph in order to concentrate and increase her reading speed,

*'I was only checking the information and the different parts of the study (.) I don't read in details anything (.) I only get the main idea of each part and then when I re-read these parts for the second time I focus on the details ... .. I do this because I do not want to waste my time reading everything and irrelevant information (.) you know I do not have time'* (Ph2/SR)

Similarly, AFR identified the main ideas of the text and wrote notes on them,

*'Ok here I wrote notes that there is only a difference in COP in the all sample. Here I am writing down the main ideas only'* (SR)

## 5. Attending selectively

65% of the readers were also only selecting specific sections related to their reading purposes to read while reading on-screen. In other words, they were not reading the entire article from its beginning to its end on-screen. Readers selected and only focused on the information that was related to their academic purposes and read for comprehension. For example, SAR stated that for time saving reasons, she selects only specific parts of the text to read and comprehend,

*'To save my time (.) I don't have time to read everything in the paper (.) I need to be selective' (SR)*

Similarly, AML explained that she was looking for definitions and basic criteria for management systems only while reading the article,

*'Because they are details and too much information (.) I don't need to read them (.) I am only looking for main ideas and main information, such as the definition of management system ahh and its basic criteria (.) I only focused on these three sections of the paper' (Ph1/SR)*

## 6. Skipping sections

In addition, 80% of the readers frequently skipped sections of the text to speed up their reading, quickly evaluating the relevance of the text to their purpose and deliberately neglecting irrelevant and challenging sections. For example, SAJ stated that she skipped sections that were not important for her reading purposes,

*'Ok here I skipped the introduction part because all these are introductory information for the topic I don't need to read these now because I had an idea about this topic' (Ph2/SR)*

## 7. Using background knowledge

Only 40% of the readers revived and used their background knowledge of specific topic while reading an academic text in order to enhance their comprehension. For instance, MAH explained,

*'Here I was thinking about the goal directed communication (.) actually I have read about this previously and I was thinking about that information and what are the connection between them (.) here they presented it differently' (Ph2/SR)*

## 8. Anticipating

5% of the readers were predicting the information in the text either by reading titles and/or an abstract of a text to enhance their reading comprehension, assess the relevance of the text and/or to save time. For example, LAM said,

*'Ok here I started reading the title and know about the authors of the article (.) the title here is a bit long actually when I read the title I thought about the information and the content of this article and in what ways it will help me in my assignment'*  
(Ph1/SR)

Similarly, SAJ mentioned,

*'Here I read the title ahh then (.) I stopped to think about its content and if it relates to my assignment (.) then I started to read the first paragraph'* (Ph2/SR)

### **9. Planning**

Also, planning was rarely used by readers. Only 25% of readers had specific and clear plans when reading a text. For example, AML in the following quotes illustrates that she first wanted to find specific parts of the text that were related to her purposes, and after that, she planned to re-read the selected sections for further detail and comprehension.

*'Because this part here is a case study that I needed to include in my assignment (.) actually my reading now is just to select the related part (.) I mean the parts that I may use in my assignment and then I will re-read them again'* (Ph2/SR)

### **10. Having a purpose**

100% of the readers were reading with a purpose. For example, they may be reading to find a specific definition, to explore specific methods or to discover results that were arrived at by using specific data collection instruments. For instance, AML in the following quotes was reading to find specific information (case studies), which is related to the use of e-commerce by Saudi students in Saudi Arabia.

*'I am searching about how the Saudi students in Saudi Arabia use the ecommerce (.) I found this paper about the ecommerce in Saudi Arabia (.) In this paper I was looking for case studies in this topic that I need to use in my assignment'* (Ph1/TA)

In like manner, LAY said that she was searching for information specifically related to the stock market in the GCC.

*'I chose this article because I want to talk about the stock market ahh in the GCC region (.) In general I want to see information about it therefore I downloaded this paper'* (SR)

### **11. Pausing and thinking**

25% of the readers stopped their reading in order to think about information that they had read previously and attempted to remember previous information in order to comprehend specific parts of a text. For instance, GAD explained,

*'I stopped my reading because I needed ahh I was trying to think and arrange the information. I was thinking about the characteristics of socially anxious people. Ahh I was explaining the information to myself in Arabic (.) this helps me to understand and remember the information'* (SR)

## **12. Scanning**

Scanning the text and reading specific parts quickly in order to find precise information related to a reading purpose, instead of spending a long time reading the article in detail was also employed by 30% of the readers. On-screen readers were mostly looking for general ideas rather than specific details. For example, SAJ noted,

*'Ok here I was reading this paragraph fast because all these are details about the measurements (.) ahh (.) I am not focusing on this information at the moment (.) I only need to know which measurements that they used in the research'* (Ph2/SR)

## **13. Using text references**

35% of the readers used in-text citations or references at the end of the article while reading to check, search and read relevant sources that might be useful for enhancing their reading comprehension and meeting their reading objectives. For example, GAD noted,

*'I found this citation (.) it is very relevant information to my topic (.) I needed to know the title of the paper (.) I searched for the article, download it and save it in one of the folder in my computer'* (TA)

## **14. Connecting ideas**

Only 15% of the readers were connecting information that they were reading with information that they had read previously in another source in order to enhance their comprehension and assess the reliability, credibility and accuracy of the information that they were reading. For example, AML noted,

*'Here this idea was not clear actually I have read about this information before and they were contradicting the idea that I knew before (.) I re-read it again and thought about it (.) actually I was thinking about this and the information that I have read before (.) I realized that I first understood it wrongly but after that when I re-read it and I could understand what he means here'* (Ph2/SR)

#### 4.2.4 On-screen CRT sub-strategies

The analysis of the sub-strategies used by readers under the critical (CRT) strategy category reveals the number of instances of the employed CRT sub-strategies. It is important to note that during on-screen reading readers were not employing critical reading strategies extensively (see 6.2.1 for full discussion and reasoning). A list of these strategies is shown below, together with the number of instances of occurrence within the data. For further clarification, these results are illustrated graphically in Figure 8, which presents in percentage the frequency of each of the utilised CRT sub-strategies.

1. Evaluating the information: 20 instances
2. Evaluating the source of the information: 10 instances
3. Evaluating the language and style: 10 instances
4. Evaluating the rhetorical structure: 14 instances

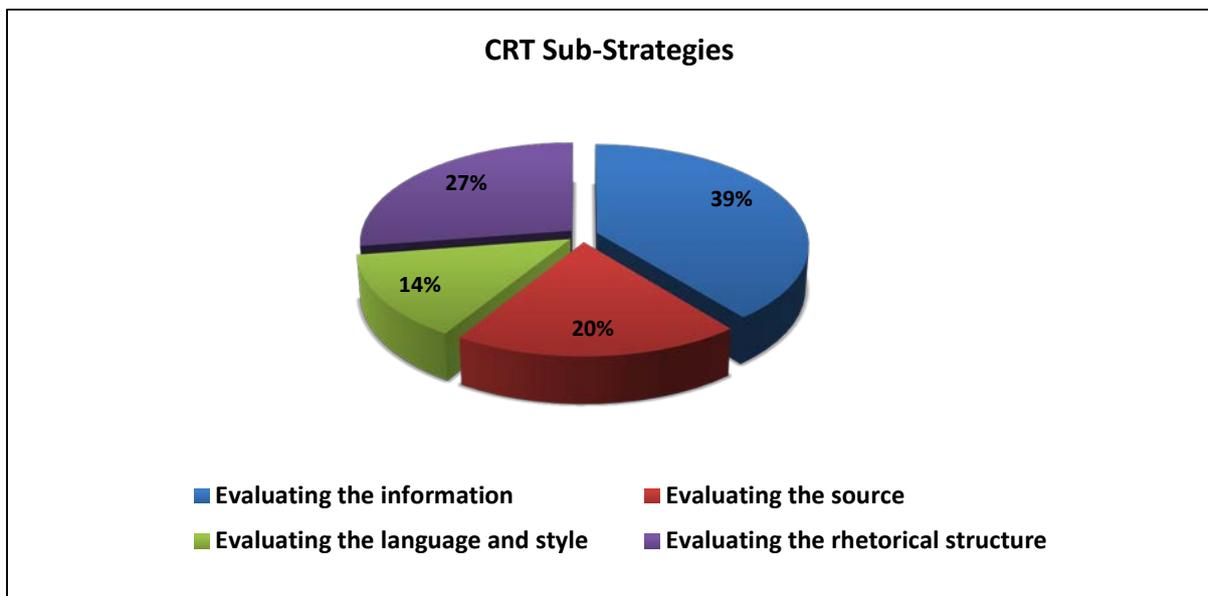


Figure 8: The frequency of the CRT sub-strategies employed (on-screen)

Each of these strategies is exemplified in the following sections by presenting quotes from the think-aloud, stimulated recalls and field notes extracts (see 6.2.1 for full discussion). In terms of distribution of these sub-strategies, the number of readers (in percentage) who employed them is identified below.

##### 1. Evaluating the information

65% of the readers evaluated the information in the text that they were reading in terms of its reliability and validity, such as assessing the authors' justification for choosing a specific number of participants or using specific methods. For example, REE noted,

*'Actually here I was thinking about their justification about choosing this sample size (.) ahh their justifications are quite good and why they choose this method and this period of time to conduct the study (.) they gave good justification for all these'*  
(Ph2/SR)

## **2. Evaluating the source**

A smaller number 20% evaluated the sources of information, such as the author's reputation, date of publication or number of citations of the paper. For example, AML said,

*'Because it is from association European society (.) it is well known but actually when I checked the date I checked it is out dated 2001 it is old'* (Ph2/SR)

## **3. Evaluating the language and the style**

Only 25% of the readers evaluated the level of the English language of the text that they were reading and its use of academic and complex language to prepare themselves socio-effectively to comprehend the text. For example, LAM noted,

*'The language of this paper is not too difficult I could understand it easily but some of the paper I feel that they are really difficult and I need to re-read the paper and translate a lot but this was simple and understandable'*

She also added,

*'When I think about the language of the text and recognise how the text is written (.)ahh help me to prepare myself to how do I need to read the text'* (Ph2/SR)

## **4. Evaluating the rhetorical structure**

30% of the readers also evaluated the rhetorical structure of the text in terms of its sections and information organisation and presentation. For instance, AML mentioned,

*'This paper is clear and easy to be read (.) ahh the structure of the sentences is clear (.) I could follow the paper easily (.) but in that paper I noticed the writers were repeating the information'* (Ph2/SR)

Having analysed and presented readers' on-screen reading strategy categories and sub-strategies which are an essential component of digital academic strategy literacy (DASL), 5.2 presents and analyses the readers' reading strategy categories and sub-strategies during print-based reading. The following section presents proposed models of interacting with on-screen reading.

### **4.3 Reading as a whole: Strategic level of on-screen reading**

It was found that the nature of the reading sub-strategies employed can be affected by the different levels of textual content interaction. The data clearly demonstrates that digital academic strategy literacy (DASL); including the nature of on-screen reading strategies can be divided into several ordered levels. Based on the new on-screen reading strategy scheme (see Table 7, p.141), TA and SR data presented in 4.2, the researcher proposes a model that demonstrates the ordering of the sub-strategies employed during reading for comprehension to deal with different points of on-screen academic research article (see 6.2.3 for further discussion). The proposed model (see Figure 9, p.163), which is one important component of DASL, consists of four categories, sub-divided into a number of sub-strategies (that all will be presented in detail in the following sections), namely:

1. Text as a whole level
2. Section level
3. Paragraph level
4. Sentence, phrase and individual word levels

The text as a whole level concerns the reader's interaction with different sections of an article, such as the abstract, introduction or conclusion. At paragraph level, readers interact with the paragraphs that comprise a section. The sentence, phrase and word levels involve interaction with, and comprehension of the elements of each paragraph. Readers assess whether the paper is relevant to their field of study, and if it has a role in their academic purpose.

(Continued overleaf)

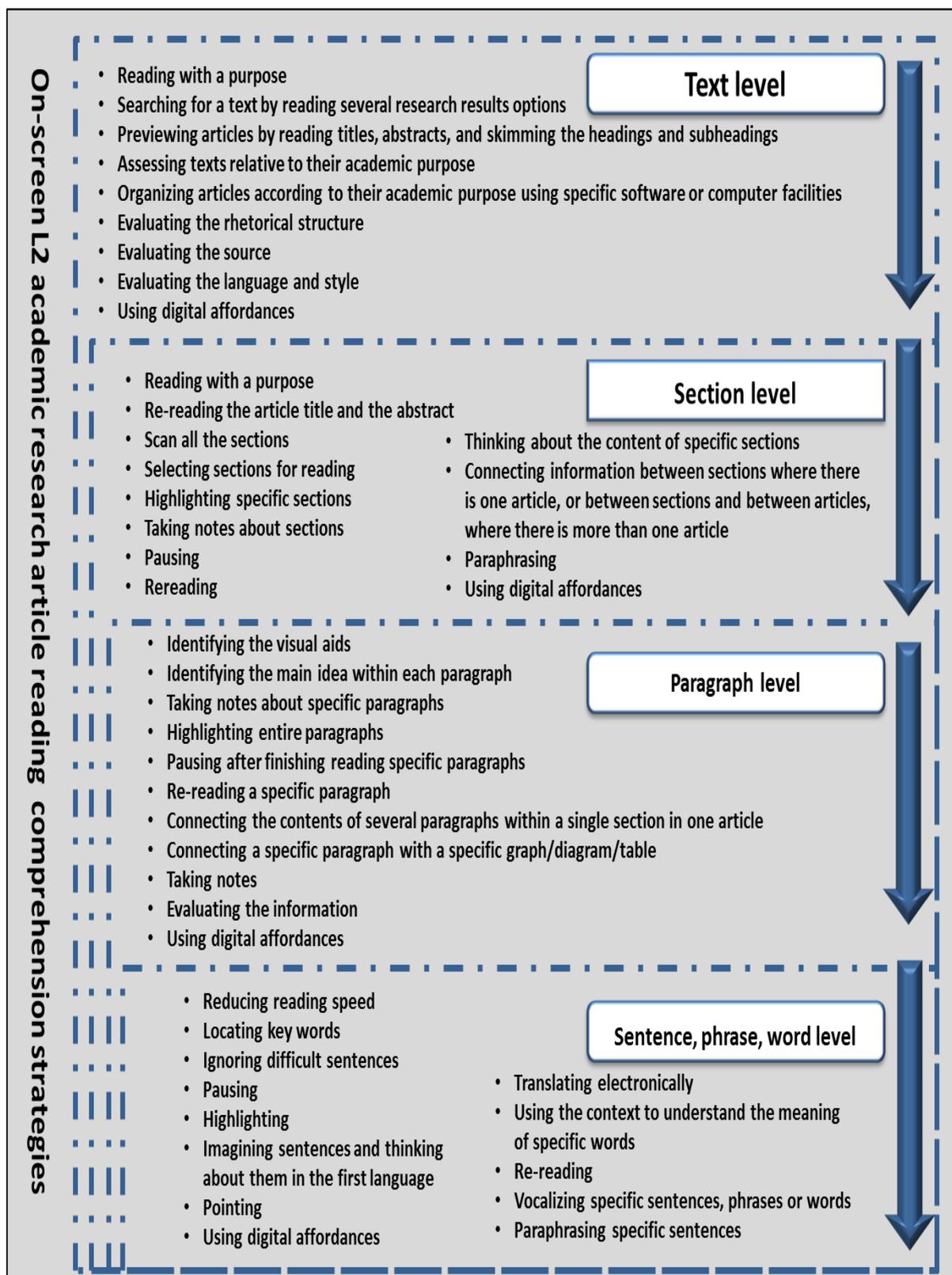


Figure 9: The proposed model of strategic levels of on-screen L2 academic research article reading comprehension

#### 4.3.1 Text level

The data shows that text level is the stage at which the readers interact with the text as a single unit. Thus at the text level, readers utilise multiple sub-strategies, these include:

1. Reading with a purpose
2. Searching for a text by reading several research results options
3. Previewing articles by reading titles, abstracts and skimming headings and subheadings
4. Assessing texts relative to their academic purposes
5. Organising articles according to academic purposes using specific software or computer facilities
6. Evaluating the rhetorical structure
7. Evaluating the source
8. Evaluating the language and style
9. Using the digital affordances

The first level comprises interaction with the text as one piece of information. All twenty readers in the current study mentioned that they engaged in searches to locate the texts that they intended to read and use for academic purposes. For example, SAJ reported,

*'After searching online to find relevant articles and read the suggested findings I read the abstract because the abstract contained mostly everything about the paper (.) if I found it interesting and if it contains good information I print it' (Ph1/Intvw)*

In addition, MAJ said,

*'At the beginning I search for papers relevant to my topic (.) ahh I read each option and choose between them' (Intvw)*

This process requires the reader to have a purpose in mind when looking for specific articles. This is exemplified in SAJ, who stated,

*'I have read the title first and then checked that the title of the article is relevant to what I am looking for' (Ph1/SR)*

AML also commented,

*'I searched to find out about how Saudi students in Saudi Arabia use the ecommerce (.) I found the paper about ecommerce in Saudi Arabia (.) In this paper I was looking for case studies about the topic that I needed to use for my assignment' (Ph2/SR)*

70% of the readers mentioned that they previewed the text to obtain a general idea about its content. Most importantly, at this stage, readers read the title of the article and then the abstract. For instance, RSH stated,

*'Actually I try to formulate an idea from the title and the abstract when I read online'*  
(Intvw)

Similarly, AFR explained,

*'First (.) I only scanned the paper and only look for the most important parts in the article that means I am reading only to get an idea about the study'* (Intvw)

AML reported:

*'First of all I read the title and the abstract and then have a quick look at the whole article (.)I check its subtitles'*

Also, GAD stated,

*'The first reading is a quick reading'* (Intvw)

Next, it comes the stage which comprises preparation for the reading process, and involves organising the reading texts. This is exemplified in HEN's response, who said,

*'I categorise the papers into groups on my laptop and in a hard copy folder according to what I need them for (.) for example those for writing introduction (.) and these for designing a device'* (Intvw)

LAM also explained the initial process of her reading,

*'First I collect around twenty articles related to one topic from Google scholar (.) and then I save them all in one file'* (Ph2/Intvw)

Similarly, MAH mentioned,

*'I classify the papers in my files'* (Ph2/Intvw)

In addition, LAY explained that she exports relevant articles to specific software,

*'At the beginning I search for papers relevant to my topic (.) after that I export them to endnote which is my library where I categorise the papers into files and name all the files'* (Intvw)

#### **4.3.2 Section level**

During the section level, the data suggests that readers begin reading and focusing on specific sections. At the section level, different sorts of sub-strategies were employed;

1. Reading with a purpose

2. Re-reading the article titles, abstract and entire sections
3. Scanning all the sections
4. Selecting sections for reading
5. Highlighting specific sections
6. Taking notes about sections
7. Pausing
8. Thinking about the content of specific sections
9. Connecting information between sections where there is one article, or between sections and between articles, where there is more than one article
10. Paraphrasing
11. Using the digital affordances

This level also includes re-reading the article's titles and abstracts. 100% of the readers mentioned that they begin reading an article by re-reading the abstract, as it provides them with an overall summary of the article and its main idea. For example, AML said,

*'The abstract is the first and the most important part of the paper that I read'*  
(Ph1/Intvw)

DAL also reported,

*'I start reading the abstract and continue till the end of the paper'* (Intvw)

BDR stated that she first reads the abstract and part of the introductory section in order to identify the author's point of view.

*'I start with the first part of the research article (.) which is the abstract (.) and the first part of the introduction to know the writer's point of view'* (Intvw)

By contrast, 10% of the readers mentioned an alternative method; they read the title and the abstract of the articles, and then skip the introduction section and read the method section immediately. For example, AFR stated,

*'Usually I don't read the introduction in most of the papers (.) I immediately read the methods'* (Intvw)

It was observed that AML,

*'Skips the introduction; she only had a quick look'* (FN)

Similarly, REE reported,

*'I start mainly with the methods then the other parts of the article'* (Ph2/Intvw)

A further 10% of readers mentioned that that they read the main title followed by the abstract and then scan the titles of the other sections in the paper and highlight the relevant ones for their academic purposes. For example, AML explained,

*'First of all I read the title and the abstract and then quickly skim the whole article to check its subtitles' (Ph2/Intvw)*

Similarly, ALA said,

*'When I read the paper on-screen I usually read the title and the abstract then I highlight the most important sections that I need to read' (Intvw)*

At the section level, surprisingly, 20% of the readers expressed their preference for reading the article in a linear manner, not skipping sections. For example, DAL stated,

*'I never jump because when I jump I fear that I will understand something different from what the paper intended to present (.) so I read the abstract and then the introduction and understand what the research is about and the researcher's aim (.) who did it and then after understanding all this information (.) I continue reading the article (.) because if I read from the middle I don't know what they are talking about' (Intvw)*

MAJ also explained that she reads the sections of the article thoroughly,

*'I start with the most important sections of the paper which is the abstract (.) then the hypothesis (.) result (.) and then the conclusion' (Intvw)*

By contrast, 80% of the readers mentioned reading sections of articles selectively. For example, SAR reported,

*'I don't read everything (.) I only read the abstract and then the conclusion and specific points in the middle' (Intvw)*

55% of the readers mentioned reading different sections with their own specific purpose in mind.

For example, REE commented,

*'I skipped the introduction part (.) because reading all the introductory information about the topic is not necessary for me because I have an idea about this topic (.) ahh... I wanted to read about the details of the study itself the methods and what they did' (Ph1/SR)*

Similarly, MAJ said,

*'I used the bookmarks to choose the section that I wanted to read; that was where the hypothesis development was' (SR)*

10% of the readers reported sometimes taking notes concerning specific sections of the article. For instance, LAM stated that,

*'In my notes usually I write the outlines of some section' (Intvw)*

DAL also mentioned,

*'When I finish a section I stop reading and rearrange my thoughts to integrate what I have learned and to think about that section (.) If it helps me and if it supports my research, or if it adds to my thinking and ideas and how? In this case, I review and re-read the main points which prompted me to write notes'* (Intvw)

25% of the readers reported that they linked specific sections within a single article. For example, AML reported,

*'I was reading this section (.) it is about Internet (.) it has linking ideas between the agriculture and the Internet (.) ahh it is interesting and new information'* (Ph1/SR)

Also, SAR commented,

*'I was connecting between these two sections here (.) ahh the data and the discussion'* (SR)

15% of the readers mentioned connecting sections across different articles. For example, FAT declared,

*'I was thinking about these two articles (.) only the methods (.) in this one they added interviews with the participants, while in this one they only performed an experiment'* (SR)

#### **4.3.3 Paragraph level**

At paragraph level, the data reveals that readers interact with the individual paragraphs within each section. Different sorts of strategies were identified when interacting with the individual paragraphs within the text:

1. Identifying the visual aids
2. Identifying the main idea within each paragraph
3. Taking notes about specific paragraphs
4. Highlighting entire paragraphs
5. Pausing after finishing reading specific paragraphs
6. Re-reading specific paragraphs
7. Connecting the contents of several paragraphs within a single section in one article
8. Connecting specific paragraphs with a specific graph/diagram/table
9. Evaluating the information
10. Using the digital affordances

60% of the readers mentioned looking for and reading the main idea of each paragraph without immersing themselves in the details, for example, AML reported,

*'I read the main idea of each paragraph'* (Intvw)

Interestingly, another interviewee, DAL mentioned that,

*'I read the first three sentences of each paragraph and then I re-read them again and continue reading till its end'* (Intvw)

At this level of focus, 45% of the readers mentioned taking notes about specific paragraphs and writing the main ideas either in their first language or in the L2. For example, DAL reported,

*'Here this paragraph supports ideas in my research. Usually I put notes in Arabic. Sometimes I highlight the entire paragraph if I am going to use the same sentences in my writing'* (Intvw)

65% of the readers paused for a short period of time (from approximately 10 seconds to two minutes) after finishing reading one paragraph to evaluate the paragraph content as one unit. For example, RSH stated,

*'I stopped here (.) I was thinking about the meaning of this paragraph as a whole and its ideas'* (SR)

20% of the readers re-read specific paragraphs; for example, LAM mentioned,

*'Here I read this paragraph to the end but I needed to re-read it to extract the main ideas'* (Ph2/SR)

10% of the readers found that they could connect information between the two paragraphs, for example, SAJ explained,

*'I read this paragraph and then I realised that this part related to the previous one (.) I needed to re-read the previous paragraph again to remember the information and then make a connection between the ideas'* (Ph1/SR)

15% of the readers found a connection between paragraphs and specific information presented in a table. For instance, REE illustrated,

*'Ok here I saw this table but I could not understand it I needed to return to, and re-read, the paragraphs that preceded it to understand it (.) that is why I moved the page up and down here (.) I read this information the first time, but I needed to re-read it again, not because it was difficult but because it was full of details'* (Ph2/SR)

#### **4.3.4 Sentence, phrase and word levels and then (print)**

Continuing on to a deeper level, the data suggests that readers utilise diverse sub-strategies to interact with and comprehend sentences, phrases and words while reading text (see Figure 9, p.163). These sub-strategies involve:

1. Reducing reading speed
2. Locating key words
3. Ignoring difficult sentences
4. Pausing
5. Thinking
6. Highlighting
7. Imagining sentences and thinking about them in the first language
8. Pointing
9. Translating electronically
10. Using the context to understand the meaning of specific words
11. Re-reading
12. Vocalizing specific sentences, phrases or words
13. Paraphrasing specific sentences
14. Using the digital affordances

75% of the readers mentioned reducing their reading speed when they encountered specific sentences or words that needed extra attention to comprehend. For example, AFR said,

*'Here with these sentences, as you can see I was reading very slowly because I needed to concentrate very hard (.) I was reading the numbers (.) actually here I needed to slow down my reading because these numbers are confusing'* (SR)

40% of the readers found that they could locate key words when reading. For instance, RSH commented,

*'Okay, I tried to focus on the key words here to get a quick idea about the paragraph'* (SR)

Similarly, MAJ said,

*'I was reading and I was picking up the key words (.) for example empirically examine and developing countries'* (SR)

90% of the readers ignored difficult sentences when reading. For instance, SAJ noted,

*'Actually here I could not understand these sentences (.) they are really complicated (.) actually I ignored them'* (Ph1/TA)

Similarly, GAD declared,

*'I ignored it at the end, what should I do? I re-read the sentence many times but I could not understand the words'* (SR)

All readers were observed re-reading specific sentences and/or words. For instance, AFR mentioned,

*'I read the first sentence of the results section but I needed to re-read it because I did not understand' (SR)*

Similarly, BDR said,

*'Here I was reading these sentences (.) actually I re-read them several times' (SR)*

Indeed, all twenty participants were observed pausing after reading certain sentences. For example, REE paused several times while reading two sentences in the text,

*'Demographic data ok [she scrolls the page down] (00:25) [she scrolls the page down] (00:45) ok this is good for the patient [she scrolls the page down] (00:32) [she scrolls the page down] ok what here? How they did the transcript go? (01:22) [she scrolls the page down] (00:31) [she scrolls the page up] (00:45) I need to re-read this [she scrolls the pages down slowly] (01:46)' (TA)*

Surprisingly, 100% of the readers highlighted specific sentences or words while reading, such as for translating purposes or/and to improve concentration. For example, GAD commented,

*'I highlighted this word because I wanted to translate it' (SR)*

Also, EMA reported,

*'I highlighted these sentences (.) to focus on the experiment (.) also I re-read them' (SR)*

25% of the readers visualised the meaning of specific sentences and thought about them in their first language. For example, REE said,

*'Everything that I read I analyse in my mind for example when I read I translate into Arabic in my mind to get the meaning (.) I imagine the sentence in Arabic and try to understand what the writer means in Arabic' (Ph1/Intvw)*

70% of the readers observed that that they were pointing while reading on-screen. For example, AML said,

*'I was pointing to concentrate on these sentences (.) these are very important and complicated sentences' (Ph2/SR)*

LAY also reported,

*'I used the cursor here to focus reading on these sentences' (SR)*

80% of the readers translated specific words into their first language while reading. For example, REE explained,

*'First I read it and I read it again (.) ah I translate the difficult words' (Ph1/Intvw)*

75% of the readers expended considerable effort attempting to understand words based on the context. For example, GAD stated,

*'I was trying to understand the word consistently from the context. I was thinking about what this word means here. Actually I did not understand' (SR)*

20% of the readers 'electronically' vocalised specific words while reading and 90% of the readers read out-loud. For example, GAD said,

*'I was checking the meaning and pronunciation of the word appetitive. I used Google to listen and learn the meaning. Then I had to re-read the sentence' (SR)*

When discussing the paraphrasing process at this level of text interaction, 10% of the readers reported contradictory practices when incorporating useful sentences into their own written documents. One reader mentioned that she copies and pastes the sections that she has read and thought about, including them in her written document without paraphrasing until she begins writing a paper. This is explained in ALA's following comment

*'If there are important points in the paper I copy and paste them into my schedule and I create a tag for them to see where I can use them in my writing when I write my report (.) for example (.) this section is about the problems with spurses (.) so I wrote here spurge problems and I made tag for it and I made a tag for these sentences but it is the same copied and pasted. I do not paraphrase until I start writing' (Intvw)*

Conversely, DAL said,

*'If I am going to use specific information from a text in my writing (.) I directly paraphrase them from the article into my report' (Intvw)*

The available analytical data also seems to suggest that interacting with a text on-screen involves an ordered process that is hierarchical and sequential in nature. The data suggests an additional level at which readers either re-interact with the text as a single piece of information, or print it out to read in greater depth.

Figure 10 presents the proposed patterns of on-screen academic reading interaction. The figure illustrates that the on-screen reading for comprehension begins with the text level and is followed by a process of deciding the relevance of the text, during which a reader either decides to proceed with reading the article or stops reading it. After that, if the reader decides to complete reading the article, s/he employs section, paragraph, sentence, phrase and word level sub-strategies as mentioned in Figure 9, p.163. Thereafter, the reader again makes a decision about the relevance of the text to his/her academic purposes. This circular process finishes by either reviewing the text on-screen or printing it out for a closer re-reading. That is, if the article is very relevant, the reader frequently prints it off for full reading comprehension; and if it is partially relevant, the reader prefers to re-read only the relevant parts on-screen. This data is further discussed in detail in 6.2.3.

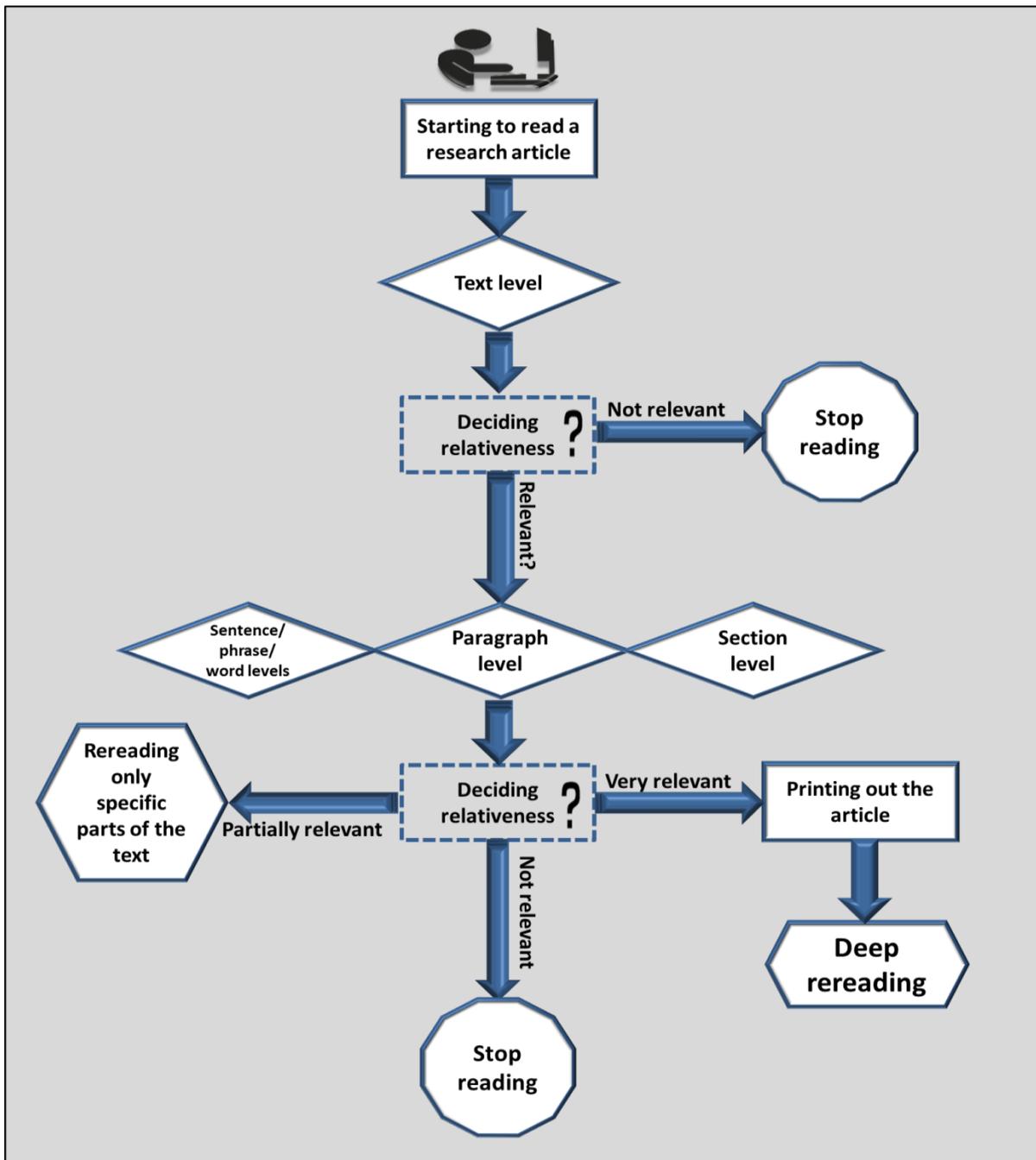


Figure 10: The proposed model of patterns of on-screen reading interaction (based on the research data)

One reader reported that after embarking on previous reading she re-interacts with the text at the text level, taking notes about the text as a whole, including its title, a summary of its content and relevant quotations (see ALA/Intvw comments in the previous paragraph). On the other hand, 90% of the readers reported concluding their on-screen reading by printing out the texts to re-read in depth. For example, HEN said,

*'If it is interesting and contains something relevant to my project (.) I print it and then I read it in details from the printed copy'* (Intvw)

Similarly, RSH reported,

*'Usually I print the paper if needed to re-read it in more detail'* (Intvw)

#### **4.4 Associated on-screen reading strategies**

TA and SR data show that there are some specific sub-strategies that follow on from one another during on-screen academic reading. For example, the re-reading strategy is linked to multiple types of strategies that either precede or follow it during on-screen reading. Highlighting of specific sentences before re-reading them or/and highlighting, re-reading and connecting ideas is linked to some strategies. The suggested model (see Figure 11) illustrates different sequences of the most frequently employed associated sub-strategies. This model presented that is based on the research data suggests that readers highlight specific parts of the text during reading comprehension either for immediate re-reading or future re-reading, for instance, it was observed that LAM,

*'highlights specific sentences and she seems that she is reading it more than once'* (FN)

Also, re-reading is associated with reading out-loud, so whenever a reader re-reads a specific part of a text, s/he might also read it out-loud. Readers also re-read to associate between ideas and information, to translate specific unfamiliar words and/or to think about specific information. For example DAL stated that she associates her re-reading strategy with other sub-strategies during on-screen reading,

*'I re-read it with little voice and highlight it and return to my writing and look where it fits and then paraphrase it'* (Intvw)

Moreover, pausing and thinking strategies proceed and/or follow linked re-reading strategies. In addition, translation strategies are followed by re-reading.

For instance, AFR explained,

*'I was slowing my reading because these are the key ideas in the paper. I need to understand them. Also while I am reading actually I am thinking about the information and I am imagining the whole scenario, the study of the paper'* (SR)

Moreover, personal vocalising and re-reading are linked. These associated strategies can be followed by note taking. Taking notes can be preceded by identifying main ideas and highlighting. Elsewhere, it is apparent that identifying main ideas and highlighting are connected. Highlighting followed by taking notes is also linked. Furthermore, highlighting, copying and pasting are always associated during on-screen reading. The strategy of locating key words and reducing reading speed are also apparently linked. Interestingly, identifying main ideas is linked to skipping strategies and/or

summarising. Finally, translating, pausing and thinking strategies are always linked when reading. For instance MAH said,

*'I was reading the abstract and thinking about how can this study links to my topic and my assignment' (SR)*

Also, REE declared,

*'Usually when I translate any word I think about the meaning that I have got and the meaning of the sentence and try to fit the meaning of that word with the entire sentence' (SR)*

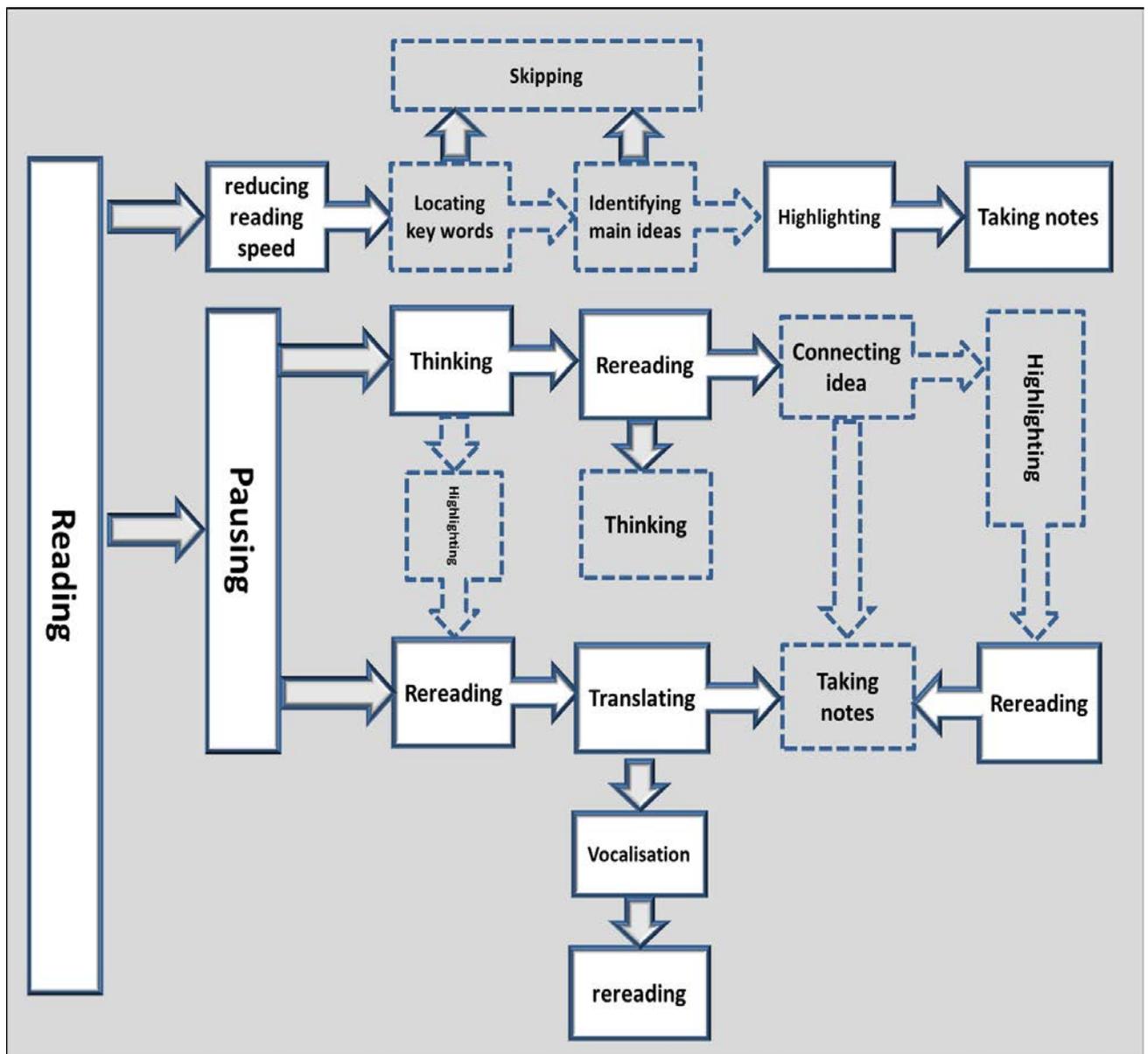


Figure 11: The proposed model of patterns of the associated sub-strategies (based on the research data)

## 4.5 On-screen reading processes

Based on the new on-screen reading strategy scheme (presented in 4.2, Table 7, p.141) which is classified into top-down and bottom up processes (see 3.9.3), it was found that digital academic strategy literacy (DASL); including on-screen academic reading comprehension requires both reading processes; top-down and bottom-up. The readers used both kinds of reading processing simultaneously during on-screen reading. However, the data also presents the differences in the frequency with which these two types of reading processes were utilised during on-screen reading. These results are illustrated graphically in Figure 12, which presents the frequency with which the two types of processing are utilised.

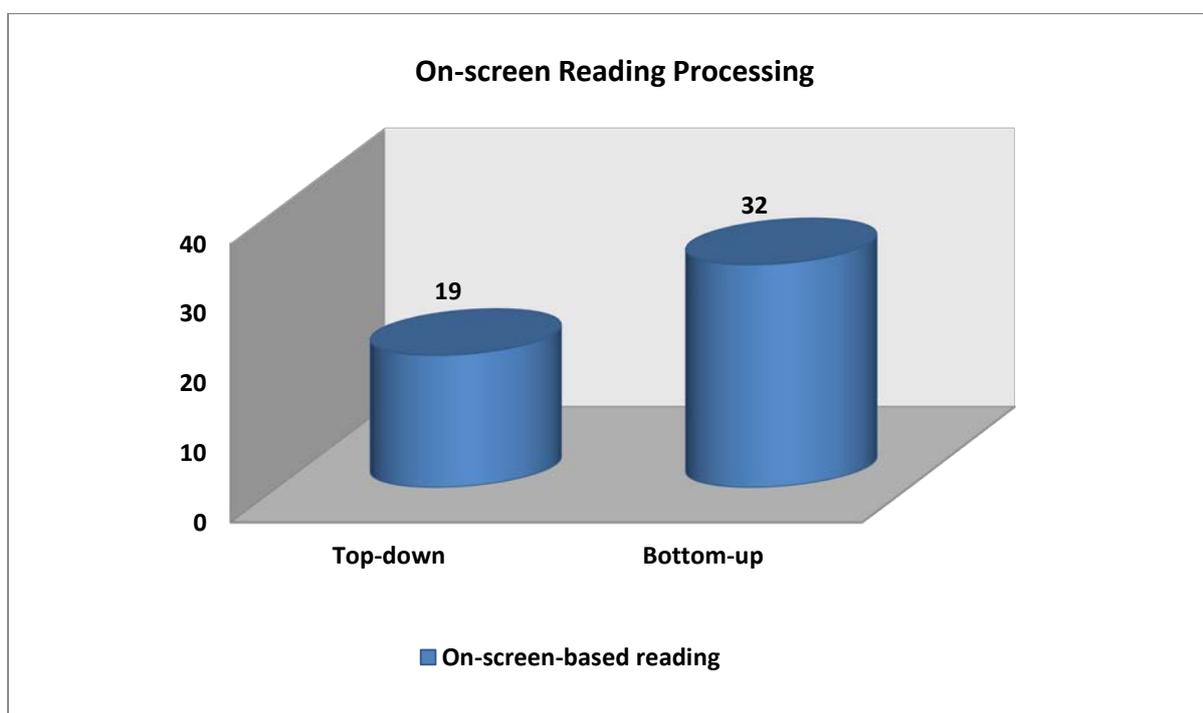


Figure 12: The frequency (the mean) of the reading processing employed during on-screen reading

The means of both types of reading processing demonstrate that the readers were relying more on bottom-up than top-down processing while they were reading on-screen texts. (Bottom-up mean = 32) versus (Top-down mean =19). For example, although they were translating, annotating and pointing, they were rarely evaluating the content of the text, connecting ideas or deeply comprehending details while reading.

In other words, interaction with academic text on-screen as it seems to be is a dual process which combines both processes. However, the rate of activating the two processes is unequal; readers tend to engage more with on-screen texts using the bottom-up approach than the top-down

approach. This revealed that the participants in the current study aimed to search for and uncover information during on-screen reading rather than to evaluate, analyse and comprehend it in-depth. This data is discussed in depth in 6.2.2.

#### 4.6 Use of e-resources

Throughout the present study, it was found that digital academic strategy literacy (DASL); including on-screen reading comprehension strategies often entails the use of digital affordances to enhance comprehension. The readers utilised different sorts of e-resources while reading on-screen, including digital presentational, navigational, translational, explanatory, illustrative, summarising, notational and collaborative resources (see 3.9.4 for further e-resources clarification and see Figure 13 for the use of digital affordances). The figure presents the frequency of use of several e-resources when reading an academic e-text followed by the number of instances of occurrence within the data and exemplified by readers’ quotes.

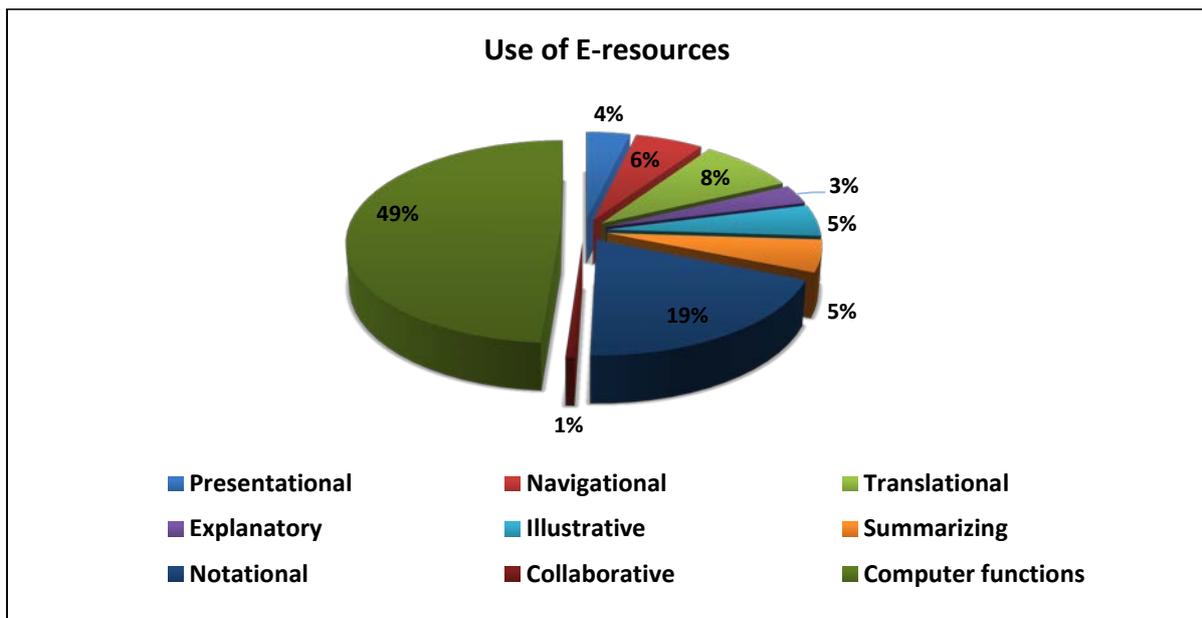


Figure 13: The frequency of use of e-resource

Several sorts of digital affordances were utilised by readers during reading on-screen. However, the participants’ employment of these affordances was not extensive. It was found that 4% (32 instances) involved presentational resources, 6% (50 instances) involved navigational resources, 3% (26 instances) involved explanatory resources, 5% ( 43 instances ) involved illustrative resources and 5% (44 instances) involved summarising resources. However, other e-resources were used somewhat more frequently; 8% (72 instances) involved translational resources, 19% (166 instances)

involved notational resources and only 1% (5 instances) involved collaborative resources. This research also contributes a new element, namely a computer function, which proved to be the most frequently-used source at 49% (419 instances).

Furthermore, three elements of the Anderson-Inman typology (enrichment, instructional and evaluative) (Anderson-Inman 2009) have been omitted from the new scheme as these were found to be inapplicable to on-screen academic reading comprehension. The use of these e-resources is exemplified in the following sections by presenting quotes from readers' actual reading. The participants' employment of these e-resources is discussed in further detail in 6.2.4.

Figure 14 presents an overview model of the affordances that digital resources offer for the L2 academic reader. The model consists of a number of digital affordances divided into sub-categories that are used during on-screen reading, namely navigational, presentational, explanatory, illustrative, summarising, notational, translational, and collaborative and computer functions. This model presents an important component of digital academic strategy literacy (DASL) that is discussed in 7.2.

(Continued overleaf)

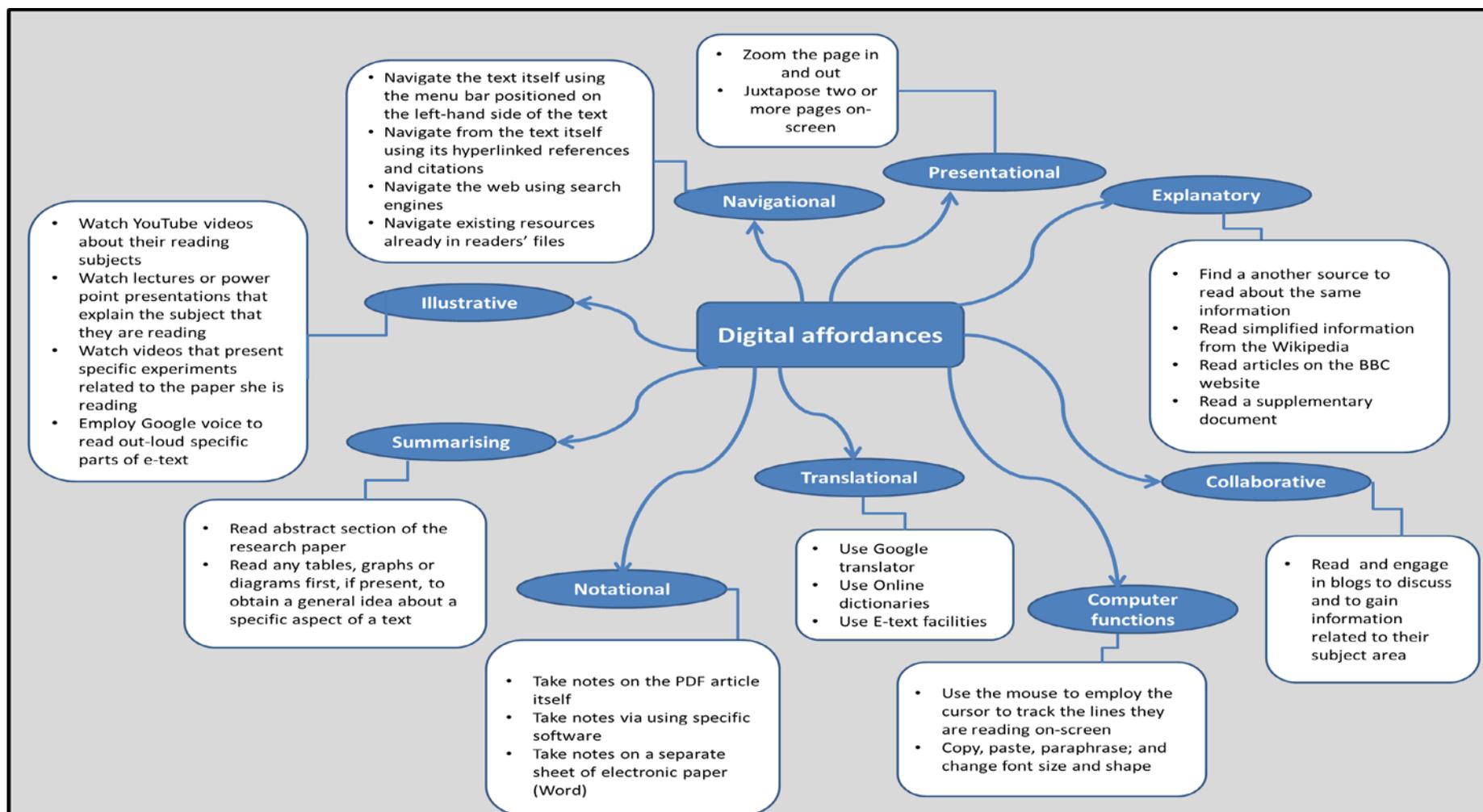


Figure 14: Use of digital affordances of L2 academic reading purposes (an overview model based on the research data)



#### 4.6.1 Presentational

The readers made use of only a small proportion of the presentational e-text resources, i.e. they were enlarging or minimising the font to suit their reading preferences and facilitate their reading. None of the readers had attempted to make use of the other presentational resources such as changing text and background colour, page layout and graphics. In this regard, only 20% of the readers utilised presentational resources during reading academic text on-screen. For example, HEN reported that she enlarges parts of the text to enhance her comprehension,

*'I look it in the PDF file and zoom it so I understand its structure and details'*

(Intvw)

Similarly, MAH said,

*'I enlarged it a bit to be clearer'* (Ph1/SR)

On the other hand, LAY declared that she reduces the size of the text for clarity purposes and to increase her reading speed,

*'Here (.) because I felt it is very big (.) actually when I minimise it I can see the page clearly (.) when it is small I can read it faster'* (SR)

Only 5% of the readers were observed juxtaposing two pages or more on-screen while reading (see Picture1 - Appendix K.1).

#### 4.6.2 Navigational

The results of the current study led the researcher to scrutinise different patterns of navigational processes, which had not been anticipated as likely to emerge in the current study. These patterns were categorised into four types of navigation for use when reading an e-text:

1. Navigating the text itself using the menu bar positioned on the left-hand side of the text
2. Navigating from the text itself using its hyperlinked references and citations
3. Navigating the web using search engines
4. Navigating existing resources already in readers' files

35% of the readers navigated the web while reading the academic text on-screen, employing the text's references and citations. For example, HEN reported that she uses the hyperlinked references in the article to navigate between several articles related to the topic,

*'The reference part in the article (.) I just click on it and it transfers me to the new article where I can look for it'* (Intvw)

In the same manner, SAJ stated,

*'When I read an article and I find that it contains useful information, I click on a related article to obtain more articles about the same topic (.) ahh, sometimes I click on the citation to find other articles on the same topic'* (Ph2/Intvw)

Also, LAY said,

*'I clicked here on the reference itself (.) ahh (.) it took me directly to the article'*  
(SR)

Other readers navigated between the sections of the reading articles using the bookmarks on the left side of the page and 25% of the readers navigated through and within the text itself, for example, AFR,

*'moves the page down/ clicks a title on the Bookmarks/ moves the page up'* (TA)

Similarly, LAY,

*'[moves the cursor towards the bookmarks/< moves the cursor down] the hypothesis = points with the finger>] ok where is the research methodology? [She scrolls the bookmarks down] what did he do in this kind of research? [She clicks on the research methodology title]'* (TA)

45% of the readers used search engines (such as Google) to find other articles related to the text that they were reading. Those readers navigated the web to find relevant resources to support their on-screen reading, such as AML who,

*'[writes in the Google search bar ARTICLE IN INFORMATION SYSTEM MANAGEMENT /clicks search/reads through the suggestions/ returns to the search bar/adds +PDF/reads the suggested information/chooses one of them/opens it]'* (Ph2/TA)

30% of the readers navigated through the existing folders in their flash memory, such as LAY, who,

*'[Opens her own folder/ reads through the titles/ chose a specific PDF file/opens it]'*  
(TA)

#### **4.6.3 Translational**

100% of the readers employed translational e-resources during their on-screen reading in order to translate a complete paragraph, sentence, phrase and/or a word. It was found that readers were utilising three types of translational e-resources while reading on-screen to enhance their reading comprehension.

1. Google translator
2. Online dictionaries
3. E-text facilities

Results show that readers are reluctant to translate using Google translator (see Picture 4 – Appendix K.4 for further clarification). 80% of the readers reported that they use Google translator to gain the meaning of a specific sentence. For example, AML reported that she sometimes translates an entire paragraph using Google translator.

*'I use Google translator (.) I put the whole sentence in Google translation'* (Ph1/Intvw)

50% of the readers used Google translator to translate a single word. For instance, SAJ reported,

*'I could not understand the meaning of the word feasibility I used Google translator to get its meaning'* (Ph1/SR)

In other instances, 25% of the readers translated not only a single word but also a specific phrase or sentence, such as MAH who,

*'highlights a phrase, right-clicks, copies the sentence, opens Google translator, and pastes the sentence] ° directly applicable studies''* (Ph1/TA)

Also, it was observed that SAJ,

*'translated a whole sentence into Arabic using Google translator'* (Ph2/FN)

The above statements reveal that 80% of the readers employed Google translator to translate the English words into their first language. However, 35% of the readers employed other e-text facilities to obtain the meaning of the word, such as right-clicking on a specific word to obtain synonyms of words in English, for example, LAM who,

*'highlights specific word/clicks right-click/clicks looks up Elicit/moves to the dictionary page'* (Ph2/TA)

Moreover, 25% of the readers declared that they sometimes translate a word using other dictionary websites. For instance, LAM reported,

*'Sometimes I translate the word by using other websites (.) sometimes there is a definite option for the word, but most of the time it is in English and I cannot understand it, and then I need to translate'* (Ph1/Intvw)

#### **4.6.4 Explanatory**

During on-screen reading, 50% of the readers used other websites to gain an explanation for specific information in their e-text. They used either Google search or Wikipedia to find simplified explanatory information that clarified the relevant content of the text they were reading. For example, SAR declared that whenever she reads complicated or unfamiliar information, she tries to find a another source to read about the same information,

*'When I read and I cannot understand specific software or specific information (.)I do a search for it and read about it in another source'* (Intvw)

During her reading on-screen SAJ also searched for an explanation for the term 'confidence interval' and read another text about it,

*'What is confidence interval? [She pasts the words in Google search/ opens new webpage] (00:12) confidence interval' (Ph1/TA)*

FAT stated that she sometimes read simplified information from Wikipedia to enhance her reading comprehension of academic research articles,

*'Sometimes I use Wikipedia to read about a specific topic in general (.) usually in Wikipedia I can find the information written in an easy language and in a simplified way' (Intvw)*

MAH reported that she reads articles on the BBC website to gain simplified information about her reading subject,

*'I read articles related to the BBC (.) the BBC has a lot of articles related to education which are very clear and understandable' (Ph3/ Intvw)*

HEN declared that she sometimes reads a supplementary document that explains the original research paper in detail,

*'if I like the paper very much I read its details from the supplementary information (.) in the article there is (esi) which means return to the supplementary information (.) so I go back and read from it' (Intvw)*

#### **4.6.5 Illustrative**

It has been established that 45% of the readers resorted to illustrative resources to enhance their comprehension of the text being read on-screen. 40% of the readers declared that they sometimes watch YouTube videos while reading on-screen to enrich their knowledge about their reading subjects. By doing so, readers unintentionally enhance their reading comprehension, for instance, ALA declared that by watching YouTube videos about 'Autism', which is related to her reading subject, she gains further information about it which in turn, enhances her reading comprehension,

*'To understand about my reading topic, I watch videos about autism and new software that helps to understand more about it' (Intvw)*

Other readers watch these videos in order to enrich their field vocabulary and thus increase their reading comprehension. For example, GAD reported,

*'I watch YouTube videos related to my study (.) for example (.) I might watch a program about social anxiety in the UK (.) this helps me a great deal because they use the words that I am reading in the articles' (Intvw)*

20% of the readers declared that they watch lectures or power point presentations that explain the subject that they are reading, for example, AML said,

*'I watch lectures or presentations in which I can hear about specific topic (.) it is really useful' (Ph2/Intvw)*

One further participant declared that she watches videos that present specific experiments related to the paper she is reading. In this regard, HEN declared that she watches short videos on her study subject, and that most articles are accompanied by a short video that illustrates the experiment or the procedure of the study,

*'I watch the video because via watching the experiment and the use of the device it becomes easier for me to get the information and understand it than when only reading (.) the new approach in engineering has videos (.) sometimes more than one video that presents how the device works' (Intvw)*

20% of the readers employed other kinds of illustrative e-resources. They electronically vocalised specific parts of the text or specific words in the text using an online vocalising dictionary (see Picture 2 - Appendix K.3). For instance, GAD

*'listens to the word pronunciation of appetitive' (TA)*

Similarly, SAJ declared that she employs Google voice to read specific parts of the e-text out-loud,

*'I copy and paste the paragraphs in Google and make Google read digitally (.) when the computer reads it for me it becomes easier than when I read it (.) actually sometimes I do this when I read the medical articles (.) this makes me understand better (.) this happen in the first stage when I read and skim and scan' (Intvw)*

#### **4.6.6 Summarising**

The data reveals that all the readers attempted to obtain condensed information about the research article. In this regard, 100% of the readers were observed directing their attention to the abstract section of the research paper in order to gain a general understanding of the text content. For example, AFR said that,

*'Actually I was focusing mainly on the abstract, because it is the simplest part of the article and provides an overview of the article' (SR)*

Similarly, GAD reported,

*'I focus on the abstract. It gives me the main idea of the entire study. Also, sometimes I only need to read the abstract of the paper, as it is not useful to read the rest of the paper' (SR)*

The abstract section is not the only way to get a general idea of the text; the readers also used other methods to gain a recapitulated view of some aspects of the text. 60% of the readers mentioned that they read any tables, graphs or diagrams first, if present, to obtain a general idea about a specific aspect of a text, as AML described,

*'I prefer to look at any tables or graphs first'*

*Researcher: 'Why?'*

*'Because I am a visual person (.) I prefer to read the colours and the drawings (.) usually, when there is a graph or a table I don't read the explanation, I go directly to the diagram or graph and try to understand the information from it (.) ahh, and then if I need to write the information (.) I write it according to my understanding of the graph' (SR/Ph1)*

In a similar manner, REE stated that,

*'I was reading this graph (.) I focused on the graph because it gives detailed information in an organised way (.) I was reading this information in the graph and thinking about what I had read in the paragraph to connect the information' (SR/Ph1)*

The data also reveals that readers employ multiple strategies when interacting with a summarising resource. Two readers engaged in re-reading, reading out-loud and annotating specific paragraphs representing a summary of the results of the research article. For example, an observation of GAD showed that,

*'< [she moves the page down] = \*\*\*] °°\*\*\* °° < ok this is the summary = [she highlights a specific sentence] ~~~~~' (TA)*

#### **4.6.7 Notational**

100% of the readers utilised notational e-resources. However, analysing those readers' use of notational e-resources reveals that readers are reluctant to highlight texts while reading more than note-taking. The data also reveals that there are four different kinds of electronic note taking.

1. Taking notes on the PDF article itself
2. Taking notes via specific software
3. Taking notes on a separate sheet of electronic paper
4. Taking notes manually on a paper notebook

100% of the readers were highlighting while reading, for instance LAY reported that she highlights the most important information for her reading purposes while she reads, as she declared that she plans to re-read this information,

*'I highlighted these sentences because they are very important (.) and I need to re-read them again later' (SR)*

Likewise, REE illustrated,

*'Here I was reading the sentences I found included important information I highlighted them because I want to re-read these sentences again' (Ph2/SR)*

It is clear that readers highlight specific sentences, phrases and/or words during on-screen reading for different purposes, such as stressing the importance of specific information or to re-read specific information. A more detailed investigation of the data reveals that highlighting is not the only notational e-resource employed by readers while reading e-text. One of the participants declared that she uses specific PDF files to make notes on the article itself while reading to keep track of her interpretations of specific information. In this regard, MAJ reported,

*'Sometimes I write notes on the article itself (.) there is an icon that I use to highlight a specific sentence and I write a note in order to save my thoughts and understanding' (Intvw)*

Surprisingly, only 10% declared that they use specific software to read which also enables them to easily write notes referenced with a small box on the e-text itself. For instance, SAR stated,

*'I use Mendeley for all of my reading, I read through =it and save all my reading (.) it is a very useful programme (.) I can edit while I am reading and write notes' (Intvw)*

The data also reveals that 85% of the readers took notes manually on their paper notebook while reading on-screen and 10% of the readers declared that they take notes on-screen, but in an external electronic document (e.g. Word.), as exemplified by ALA,

*'I make a schedule (.) I put the title of the article and the author and write notes' (Intvw)*

Similarly, AML wrote simplified notes in a Word document accompanied by the page number as a reference to enable her to re-read specific information from that reading text in the future,

*'Ok here I wrote the abbreviation of reference ref to write the title of the paper or the link (.) so when I return to this document later on I can go back and re-read the information from the original paper itself and I wrote the page number so when I re-read the in my word I can easily and quickly return to the page in which I took these information' (Ph2/SR)*

Also, it was observed that MAH wrote notes using a Word document on the computer screen,

*'She writes notes in a Word document onscreen' (FN)*

In the same way, LAY stated that she uses Endnote (software) to register notes and ideas on specific information while she is reading on-screen.

*'I can write organised notes, and I can highlight the important parts (.) my colleague taught me to do that on Endnote to save my ideas and my interpretation' (Intvw)*

#### **4.6.8 Collaborative**

Readers were not effectively activating collaborative e-resources while reading on-screen and they engaged mostly in individual cognitive reading processes. 100% of the readers were poorly involved with all collaborative e-resources while reading on-screen, such as online chat, email links and podcasts. None of them used any of the collaborative e-resources (apart from blogs) to gain further explanatory information about a subject during their on-screen reading. Only 30% of the readers declared that they sometimes read blogs to gain information related to their subject area in order to enrich their knowledge. For example, ALA noted,

*'I also read the blogs of those with autism to understand more about them and I read about their stories' (Intvw)*

Another respondent, MAJ declared that she reads blogs and discussions online on a specific topic to enrich her knowledge,

*'I read blogs (.) they discuss information that is related to my topic (.) I find them very useful (.) usually when I read about the subjects that I am reading in these blogs or the websites that people create (.) I find them easy to understand as they present and illustrate the information in an easy way (.) after that (.) I return to the research paper that I am reading and try to understand it' (Intvw)*

Only one participant declared that she sometimes engages in these blogs to discuss specific parts of a paper. GAD reported,

*'I also read blogs related to people sharing their psychological problems and I participate sometimes' (Intvw)*

#### **4.6.9 Computer functions**

On the other hand, the readers frequently utilised other digital affordances not mentioned in Inman's e-text support taxonomy (Anderson-Inman 2009) (mentioned in 3.9.4), such as software applications, copy and paste and multi-tasking. For example, 40% of the readers used specific software to:

1. Tag relevant articles
2. Mark the articles that have been read or not read
3. Mark the highly important articles to their field
4. Save, and sort the articles into specific folders

For instance, SAR reported that she uses Mendeley software to read as it enables her to organise her reading lists, save them, tag the ones that she has read and signal the most relevant ones. She said,

*'The most important programme that I use for all my reading is Mendeley (.) I read through it and save all my reading (.) it enables me to organise the research articles into folders'* (Intvw)

Moreover, the majority of the readers 70% employed e-text resources for the purposes of their academic writing, including copy, paste, paraphrase; and changing font size and shape. LAY explained,

*'I cut, paste and place it into the writing because I want this information in this way and this sentence in this way (.) so I take it and I want to write this sentence in this way'* (SR)

100% of the readers made use of the practical facilities of e-text, such as copying, pasting, and searching. They also employed them to save time and effort; and to enhance their use of other e-resources, such as translating electronically, searching for related information and extending their reading. This is exemplified by SAJ,

*'I copy and paste it in Google either to translate or search for a specific topic (.) I find it easier than typing every single word (.) ahh, it is also quicker'* (Ph2/Intvw)

In addition, all the readers used the mouse to employ the cursor to track the sentences that they were reading on-screen. For instance, REE reported,

*'I use the mouse to point to the sentences (.) it helps me to'* (Ph2/Intvw)

Three readers also employed external e-resources to support their on-screen reading, such as using a mobile phone to take notes. This is exemplified by REE's comment,

*'Sometimes when a new idea comes into my mind while I am reading I write it immediately into my memo on my iPhone'* (Ph1/SR)

10% of the readers used their mobile phones to translate specific words that they came across while reading on-screen, as observed in the case of LAM,

*'[She uses her iPhone/returns to reading the paper]'* (Ph2/TA)

The data also reveals a number of interesting findings regarding the use of e-resources. Firstly, there is no specific sequence of utilising the e-text resources. Readers are able to employ any of these e-resources in a different sequence, according to their needs. For example, the reader can watch a YouTube video to gain an illustration, read explanatory documents, highlight, take notes and translate, while others might read the article first, watch lectures or presentations about specific subjects and then re-read the article. Also, during their on-screen reading task all the

readers used computer facilities to enhance their on-screen text interaction. They copied and pasted text using the mouse to track or focus on specific sentences, phrases and/or words. In addition, there were a few readers who used different sorts of software applications while reading in order to facilitate their reading. These results match those observed in Park & Kim's (2011) study, where readers used computer functions, such as the computer mouse and spell and grammar check while reading on-screen. Furthermore, reading on-screen is a multi-tasking activity. The reader adjusts the font of the article, opens a new webpage, reads in another document, returns to the original, uses an online dictionary, translates a word, and then returns to the original text. For instance, MAH observed,

*'I need Google translator [she opens a Google translator page/returns to the reading article/highlights a specific word/click copy/ returns to Google translator page/pastes the word/clicks translate/returns to the reading article]ok' ( Ph1/TA)*

Observing the readers during their on-screen reading, having them reflect on their reading challenges during the stimulated recall and interviewing them regarding their on-screen reading challenges yielded interesting data that illustrates why readers are discouraged from on-screen L2 academic reading. The following section illustrates the challenges that the readers experience during on-screen academic reading.

#### **4.7 The challenges of on-screen reading encountered by L2 academic readers**

The findings demonstrate the various challenges affecting L2 readers' DASL competences and capabilities; including reading comprehension when reading academic text on-screen. The data reveals that on-screen L2 academic reading combines all these issues interchangeably; see Figure 15 (the proposed model) for on-screen reading challenges. The model presents a categorisation of the challenges that readers experienced during their on-screen academic reading. It consists of five main reasons for the challenges reported by L2 readers;

1. Lack of digital literacy competence and capabilities
2. Physical issues
3. Lack of familiarity with on-screen academic reading strategies (behavioural issues)
4. L2 language proficiency
5. Unfamiliar content

These challenges are important to be understood as they represent the barriers that demotivate readers to acquire and master digital academic strategy literacy (DASL); these challenges are presented in detail in the following sections and discussed further in 6.3.

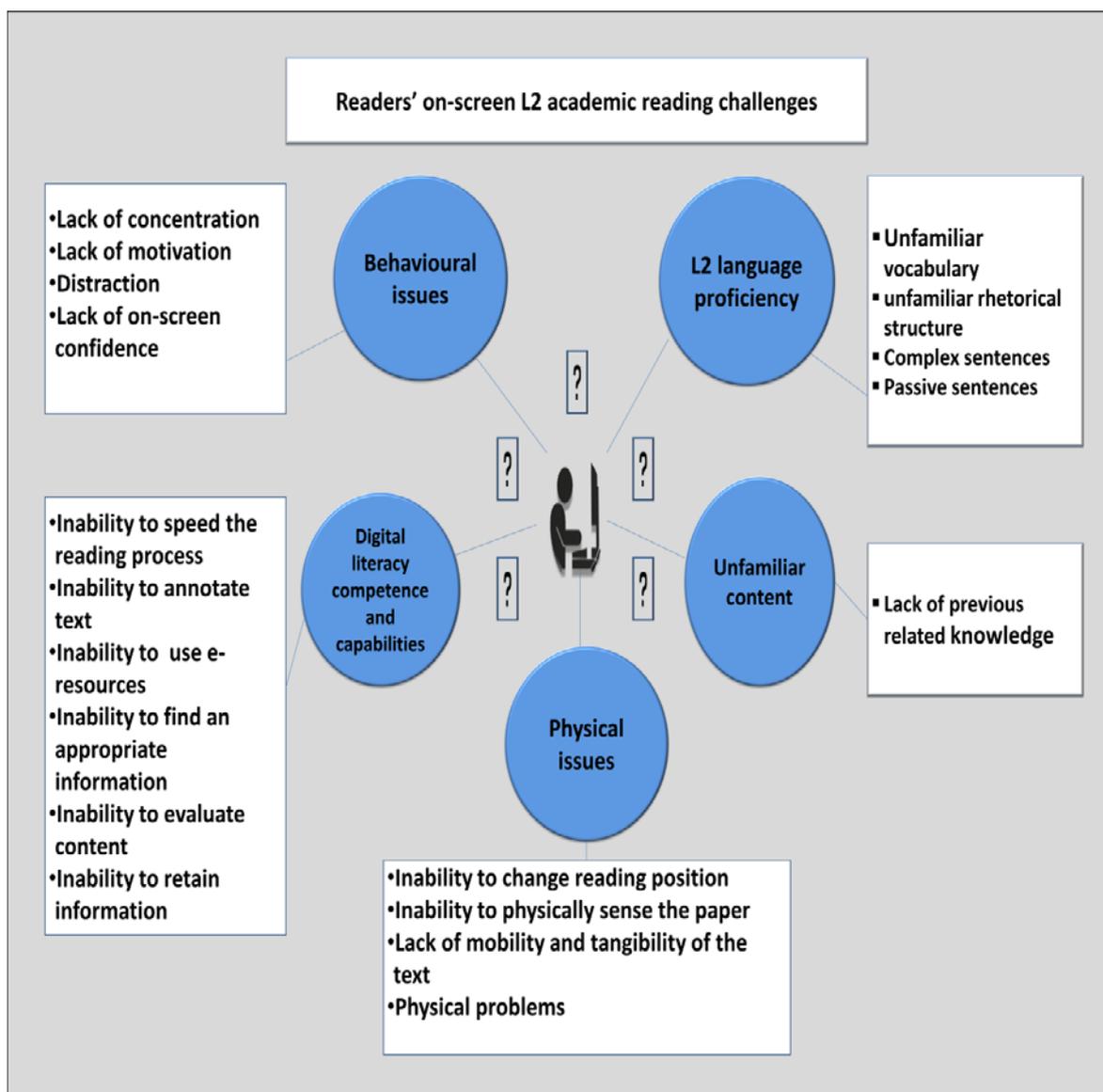


Figure 15: The proposed overall model of postgraduate readers' on-screen L2 academic reading challenges (based on the research data)

#### 4.7.1 Digital literacy competence and capabilities

The data shows that readers' lack of digital literacy competence and capabilities are one of the causes of on-screen reading comprehension challenges. 80% of the readers reported that on-screen reading reduces their reading speed when compared with reading printed paper. For example, SAJ said that reading on line slows her reading speed,

‘Actually, my problem with online reading is that it makes my reading slower’  
(Ph1/Intvw)

REE also reported that she has a feeling of not being able to handle and interact with the text on-screen as effectively as on printed paper, which in turns reduces her reading speed,

*'The other problem is that when I read online I feel that I read slower than when I read from the printed paper (.) I can handle the printed paper and interact with the information quicker than the information that I read online'* (Ph2/Intvw)

The data also reveals additional challenges related to the employment of some reading sub-strategies. In particular, 80% of the participants declared that one of the challenges hindering their on-screen reading was the inability to highlight, write notes and underline texts on-screen. 70% of the readers reported that taking notes while reading on-screen was confusing, as they could not make notes on the text itself. For example, LAM reported that she avoids reading on-screen as she prefers to underline and draw symbols during reading which she cannot do on-screen,

*'Because I need to underline and draw symbols (.) but on-screen I cannot do that'*  
(Ph1/Intvw)

LAM also in her following quotes reveals that she lacks the capabilities to use software to annotate during on-screen reading,

*'In addition, I downloaded a software program for writing notes on screen, but I could not use it (.) It is not easy and I did not like the idea of writing my notes on-screen (.) I prefer to write my notes on the paper as I am reading (.) ahh, it is easier for me (.) I have written my notes manually on the paper as I read from it for a long time'*  
(Ph2/Intvw)

50% of the readers mentioned that they cannot highlight using different colours when reading on-screen. For example, ALA declared that she prefers to highlight using different colours to differentiate between the text content as it enhances her reading comprehension. However, on-screen she does not know how to do this,

*'I don't prefer to read it on-screen as I cannot use different colours to differentiate between the information and categorise it (.) so when I read on-screen I highlight with only one colour(.) ahh I do not know if there is a way to use different colours on-screen'* (Intvw)

Similarly, 30% of the readers mentioned that they found it more challenging to retain information that they read on-screen. For example, REE reported,

*'When I want to remember something or if I wanted to remember the information (.) I read it from the printed paper (.) ahh when I read online (.) I forget most of the information'* (Ph2/Intvw)

85% of the readers mentioned that they found it challenging to think critically and employ critical reading strategies when reading on-screen. Those readers mentioned that they print-out the paper if they want to read the article critically. For example, AFR said,

*'I cannot think critically when I read the article on the screen (.) I need to print it out and then read it'* (Intvw)

In the same way, RSH said,

*'Whenever I want to do critical analysis for a paper I need to print and read it from an actual printed paper (.) I cannot think critically while I am reading on-screen (.) well I prefer printed formats'* (Intvw)

#### **4.7.2 Behavioural issues**

The data also reveals that 65% of the readers frequently lost their concentration while reading on-screen. For instance, REE declared that on-screen reading for her is associated with pleasure reading and not academic reading, thus she finds it difficult to concentrate,

*'When I read on screen I feel that I am not reading to study (.) and I easily lose my concentration'* (Ph1/Intvw)

Also SAJ said,

*'Here I was not concentrating. Actually, I was thinking about something else. This is one of my problems when I read on-screen. I lose my concentration regularly and think about something else'* (Ph1/SR)

Similarly, REE stated she cannot concentrate during on-screen reading,

*'I feel that I cannot concentrate when I read on-screen'* (Ph1/Intvw)

Another challenge that bears a relation to readers' reading concentration is becoming distracted. 60% of the readers mentioned that on-screen reading is not as academically effective as reading from printed paper, i.e. it allows for distractions (such as surfing the net, watching YouTube videos, checking emails and social websites) which can disturb their academic reading and concentration. For example, AML stated that whenever she reads online, she checks her email and watches irrelevant YouTube videos,

*'When I read online I do other distracting activities, such as checking my emails and watching YouTube (.) It is not for studying at all (.) I feel I am in the mood for studying when I read from actual books or printed papers'* (Ph1/Intvw)

In the same manner, SAJ illustrated that on-screen reading is a gateway of escape from academic reading,

*'Reading on-screen is sometimes distracting (.) It makes it easy to escape from my studies and reading (.) You know there is Facebook and Twitter (.) also sometimes I chat with friend on Skype (.) the availability of all these options distracts my concentration (.) I know in my mind that I can do many things instead of reading (.) this makes it very difficult to continue reading'* (Ph2/Intvw)

Also, GAD mentioned,

*'I need to check my email and do several things and see my Facebook'* (Intvw)

In addition, REE stated that on-screen reading is mentally associated with entertainment purposes,

*'I tend to associate reading on-screen with entertainment, so when I am on a computer...I search for entertainment stories or sites and read them, but I do not read for my studies...I cannot concentrate because having and being on the net distracts my concentration and reading'* (Ph1/Intvw)

In a similar vein, 50% of the readers reported that they faced difficulties in reading for a long time on-screen as they lost their concentration and were unable to comprehend. For example, LAM reported,

*'Usually I feel bored when I read for a long time and I lose my concentration'*  
(Ph1/Intvw)

In a similar manner, HEN said,

*'Actually (.) I started to lose my concentration (.) I have got bored from reading (.) Usually when I read for a long time on-screen I get bored and I cannot concentrate and understand'* (SR)

#### **4.7.3 Physical issues**

Other issues that ensure that readers find it challenging to read on-screen are physical ones associated with on-screen reading. For example, 65% of the readers reported that on-screen reading restricted their movement while reading in that they are less able to change their reading position and must stay facing the screen for long periods. 35% of the readers felt uncomfortable reading from a screen, as they preferred to sense, hold and read from actual hardcopies. For instance, REE stated that she prefers to hold the paper and change her reading position while reading,

*'I prefer to hold the paper and then release it on the desk...I mean I can read differently with the paper rather than on the screen, which is fixed in one place'*  
(Ph2/Intvw)

Similarly, LAY reported,

*'...but you know when I am reading on the screen I feel that my hands are not free to move between the pages'* (Intvw)

In addition, 15% of the readers reported that reading in one position over a period of time affected their reading motivation and sense of achievement. For instance, BDR said,

*'Reading from my computer and facing the screen for a long time make me less motivated and sometimes I stop reading (.) I do not feel I am totally engaged (.) ahh I do not feel that I understand or get the information'* (Intvw)

Moreover, 55% of the readers indicated that having the text on-screen restricted the number of situations in which they were able to read; that is, they noted they were unable to mobilise on-screen texts everywhere and read them at any time as they needed their computers in order to read on-screen, and paper reading was thus considered more practical. MAH for example stated,

*'I can carry the printed paper with me everywhere (.) on the bus (.) at home everywhere...I feel carrying paper is easier than carrying a laptop and charger'* (Ph1/Intvw)

20% of the readers also reported that reading on-screen can cause vision problems or that they already have vision problems connected with on-screen reading. For instance, HEN reported,

*'I cannot concentrate when I read on-screen because the light of the screen causes irritation in my eyes...this distracts my attention'* (Intvw)

Finally, 45% of the readers indicated that they preferred to use an object while they read to track the sentences and that during on-screen reading, it is more difficult to apply this kind of strategy, and this may negatively affect their concentration and comprehension ability. For instance, SAJ reported,

*'The most important thing about reading print is that I love to follow my reading using my pen or thumb—this makes me concentrate...it is difficult to do this on-screen'* (Ph1/Intvw)

#### **4.7.4 L2 language proficiency**

Although this study is not focusing on language learning, the data yielded by this research provides further evidence that reading in L2 causes reading to be challenging. 35% of the readers pointed out that reading in English was one of the biggest challenges hindering their reading comprehension, for example LAM said,

*'Actually reading the articles and the book here is very difficult (.) You know reading in general here is very difficult and challenging. Why? Because of the English'*

*language (.) Here I need to read everything in English (.) It is really difficult to understand everything in an article or a book' (Ph1/Intvw)*

LAM stated the kind of challenges she experiences when she reads in the English language, such as losing concentration and reading slowly.

*'Reading in English makes me lose my concentration.' 'In English I cannot concentrate and read as fast as I read in Arabic' (Ph1/Intvw)*

In an interesting case, LAM reported that reading in English is a barrier to her imagination and thinking processes. She stated that reading in English does not enable her to think and analyse the information that she reads, as it limits her thinking abilities. She said,

*'Actually, the language is a barrier for my thinking now (.) I cannot think in English, but I have to read in English (.) This is very problematic' (Ph1/Intvw)*

She also explained that reading in English language (L2) is a barrier to her thinking abilities and that it limits her productivity,

*'If you asked me to explain something in Arabic I will tell you the details and very smart stuff that you did not expect, but if you asked me to describe or talk about it in English, I wouldn't be able to think and give you details. My thinking will be very limited and very superficial (.) This happens in my reading (.) I cannot think deeply in English because my level of English language is low (.) Ahh, so (.) this makes my understanding difficult and superficial when I read in English'*

A closer look at the data reveals that 85% of the readers declared their inability to understand English vocabulary which is at times a barrier to their L2 academic reading comprehension while reading. In this vein, 40% of the readers found it challenging to understand general English vocabulary while reading. For example, SAJ said,

*'Here I have read this word needlessly (.) Ahh, I did not understand its meaning here (.) I needed to re-read it again to realise its meaning within the whole sentence' (Ph2/SR)*

LAM also had difficulties understanding the meaning of some of the academic words, such as

*'I have got these words, such as distinct forms and neural circuitry (.) I could not know them at the beginning (.) I needed to re-read the sentences to understand, or at least I get an idea about, the main idea here' (Ph1/SR)*

Likewise SAJ was questioning the meaning of the word 'halved',

*'What halved here? What does it mean halved?' (Ph1/TA)*

In addition, 55% of the readers found that they could not understand vocabulary related to their field of study while reading. For instance, REE commented,

*'I did not understand the meaning of this word anthropometry (.) ahh, I translated it into Arabic (.) I used the Macmillan' (Ph1/PR)*

LAM also reported that she could not understand the meaning of a specific technical word, and then she translated it to her first language using a dictionary installed on her Smart Phone,

*'Okay, here I read the title of this section but I could not understand this word, ahh, postulates (.) I translated the word into Arabic (.) Ahh, here I first typed it into my iPhone dictionary and then I have got its meaning'* (Ph2/SR)

Moreover, 45% of the readers mentioned that the style of the text contributed to the challenges that they faced during reading. For example, LAM reported,

*'If the article was not organised into clear paragraphs and sections, it became difficult for me to follow'* (Ph1/Intvw)

She also stated that long paragraphs affect her comprehension fluency and thus she needs to re-read frequently,

*'I struggle with long paragraphs (.) usually when I read a long paragraph (.) ahh (.) when I reach the end of the paragraph I forget the beginning of the paragraph and thus I need to re-read the beginning of the paragraph to connect the ideas together (.) also the references between the sentences are problematic for me (.) I easily forget what I was reading and then I need to re-read the previous sentence to connect the ideas'*

Further evidence supporting these findings is that 35% of the readers demonstrated that they found it difficult to understand sentences written in a passive voice and in a complex manner that consisted of more than one idea. For example, LAM said,

*'Actually, here I read these two sentences more than once (.) I could not understand them (.) Ahh, I think I could not understand the meaning of the sentence (.) it is too long (.) Ahh (.) I needed to re-read it and think about what the author means by this (.) I think the sentences here were also complicated (.) I am not sure about the structure of the sentences (.) I needed to re-read the sentences (.) they are connected together and too long'* (Ph1/SR)

Similarly, RSH said,

*'Because it is written in a difficult way (.) Ahh (.) here it is in the passive (.) I needed to re-read it to understand the exact meaning of the sentence'* (SR)

Interestingly, one reader (AFR) mentioned that the style of writing in English sometimes makes it challenging for her to comprehend,

*'they write here in the text it is not hard to do it(.) they can say (.) it is easy to do instead of It is not hard (.) this kind of writing and describing sometimes make it hard'*

*for me to understand when I read the article(.) I need to think more with this kind of writing' (Intvw)*

#### **4.7.5 Unfamiliar content**

A further on-screen reading challenge that has been observed, is that associated with reading unfamiliar text content. 25% of the readers faced challenges when reading statistical information in academic texts. For example LAM said that comprehending statistical information of which she has no prior knowledge is challenging,

*'Ok, here the sentences are very difficult (.) They are presenting the details about these statistics (.) actually I read them once (.) but I could not understand the statistics' (Ph1/SR)*

Likewise, REE declared that comprehending numbers and statistical figures is challenging,

*'Here the results (.) Ahh, my problem is the numbers and the statistical figures (.) I don't have any idea about them (.) I cannot understand this information written in numbers' (Ph1/SA)*

60% of the readers reported that they found it difficult to understand specific text content related to their field of study, for example SAJ reported,

*'It is not written in a direct way (.) what is this two by two factorial design?! (00:42) [She highlights the words] I will research in Google [she opens a webpage, connects to the Internet, copies and paste the words in Google search space, clicks the first suggested result] (00:31) ok ° \*\*\*° (00:10) two by two factorial design is a kind of method ° \*\*\*° (00:28) ok good' (Ph2/TA)*

Similarly, AML explained,

*'First I tried to read it but I found the information was complicated and I could not read about it (.) it is talking about satellite and transmission (.) ahh actually I am not interested in this information' (Ph1/SR)*

Having analysed and presented readers' on-screen reading challenges, functional reading strategies and sub-strategies, the next chapter presents the nature of print-based academic reading comprehension.

# Chapter 5: **Print-based academic reading comprehension**

## **5.1 Introduction: Synthesis of overall findings**

The present chapter presents an overview of issues related to print-based academic reading comprehension, namely functional reading strategies, sub-strategies and reading challenges. The chapter first of all, is concerned with the strategic nature of interaction with print-based academic texts (see 5.2). The section describes the reading strategy categories; problem-solving, support, global and critical strategies; and the sub-strategies that the readers employed during print-based reading. These are presented (with extracts) from four different sources of data to achieve triangulation: think-aloud protocols (TA), stimulated recalls (SR), researcher's field notes (FN) and interviews. The section presents and compares the frequency (quantity) of use of each of these strategies in detail. A comparison is then drawn between the most and the least used sub-strategies by analysing the number of participants who employed each strategy during the print-based reading task. Section 5.3 brings to light the challenges that readers experienced with regard to print-based L2 academic reading comprehension.

In 5.4, the chapter compares and contrasts the similarities and the differences between print-based reading and on-screen reading. In section 5.4.1 the differences and the similarities between the reading processes: top-down and bottom-up, of print-based and on-screen reading are presented. These findings show that these two reading processes are activated during the two reading formats; paper and on-screen. However, the frequency of use of the two reading processes differs. The functional reading strategy categories and sub-strategies of print-based reading and on-screen reading are compared and contrasted in 5.4.2 and 5.4.3. In both reading formats; print and on-screen, readers employed PROB, SUP, GLOB and CRT strategies. However, the frequency of use of each of these types of strategy differs in relation to the two reading formats.

## 5.2 Print-based functional reading comprehension strategy categories and sub-strategies

It was found that the readers used the four functional categories of reading strategies during their print-based academic reading comprehension, namely critical (CRT), global (GLOB), problem-solving (PROB) and support (SUP) reading strategies. Figure 16 compares the frequency with which different reading strategy categories were employed during print-based reading.

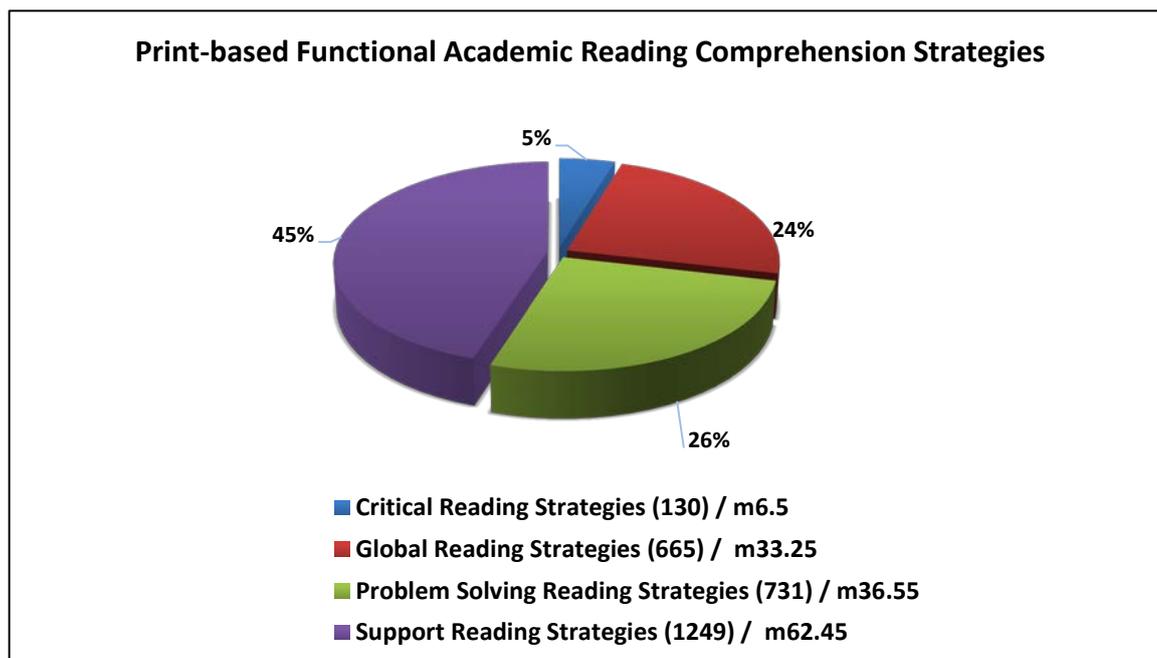


Figure 16: The frequency (number of overall instances) of the print-based academic functional reading strategies employed by participants (n = 20)

The evidence shows that the most frequently employed strategy was that of support reading strategies (45%). For example, readers often vocalised, annotated, confirmed and changed their reading speed. Problem-solving strategies were also frequently employed (26%). For example, readers were translating, pausing and re-reading text as they went along. The third most employed strategy was the global reading strategy (24%). For example, readers were skipping text, engaging their background knowledge, previewing and identifying main ideas. Critical reading strategies, by contrast, were used much less frequently (5%).

The following sections exemplify (with extracts from the data) the application of the sub-strategies of each of these categories together with their frequency of use. These data are discussed in detail in 6.4.

### 5.2.1 Print-based PROB sub-strategies

Readers in the current study employed various sorts of problem-solving (PROB) sub-strategies when engaged in print-based reading. It is interesting to note that the most common print-based PROB reading comprehension sub-strategies used were re-reading, changing reading rate, pausing and thinking. On the other hand, the least employed PROB sub-strategies were ignoring difficult sections, translating and separating sections. A list of these strategies (in no particular order) is shown below, together with the frequency of occurrence within the data.

1. Changing reading rate: 95 instances
2. Re-reading: 115 instances
3. Using context: 45 instances
4. Pausing: 97 instances
5. Thinking: 95 instances
6. Pointing: 42 instances
7. Ignoring difficult sections: 21 instances
8. Translating using hard copy dictionaries: 0 instance
9. Translating electronically: 22 instances
10. Separating text content: 25 instances
11. Connecting text content: 32 instances

For further clarification, these results are illustrated graphically in Figure 17, which presents the frequency of use (expressed as a percentage) of each of the problem-solving reading strategies during the print-based reading task.

(Continued overleaf)

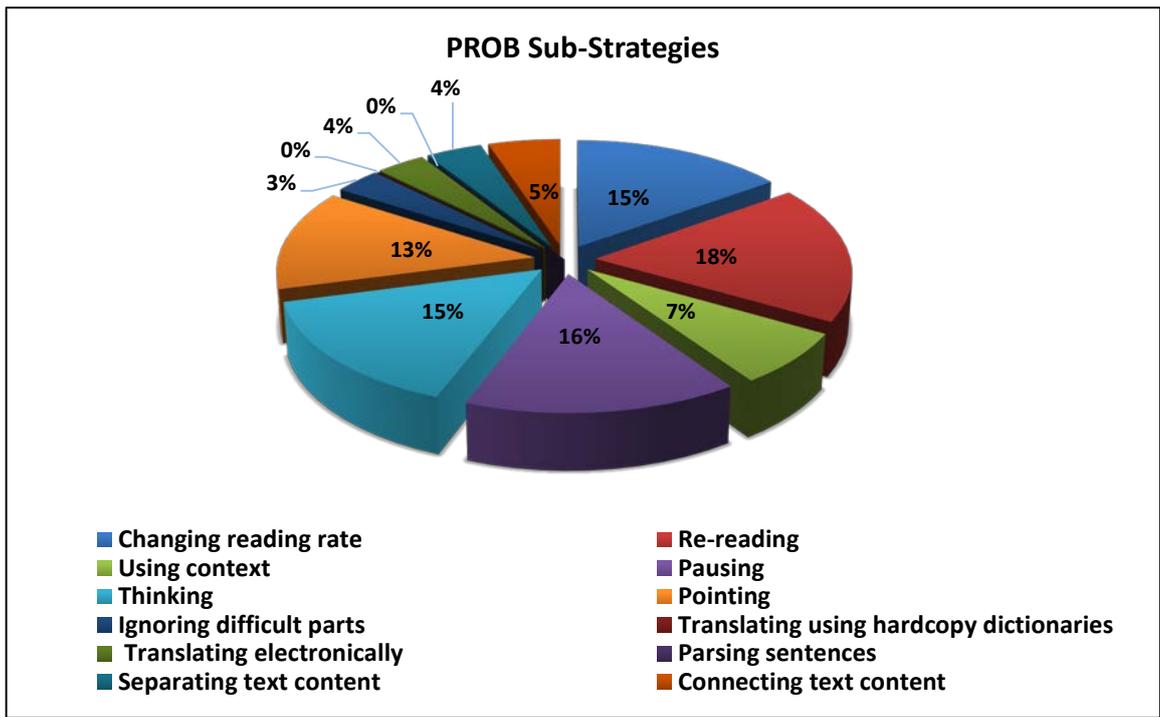


Figure 17: The frequency of PROB sub-strategies employed (on printed paper)

Each of these strategies is exemplified below through statements by readers based on their actual reading experience (see 6.4.1 for further discussion).

**1. Changing reading rate**

75% of the readers altered their reading rates to comprehend the text during print-based reading. For instance, AFR stated that if she notices important information relevant to her academic reading purposes, she slows down her reading speed to solve a comprehension problem,

*'Here, while I was reading, I noticed important information that the participants had no experience playing with the wii fit (.) I needed to understand this information (.) this information is really important; thus I read it slower than normal and I underlined it'* (SR)

Also, SAJ was observed spending more time than normal reading specific sentences that needed an extra effort to be decoded,

*'... reading the first seven lines slowly and carefully'* (Ph1/FN)

**2. Re-reading**

100% of the readers in the present study employed the re-reading strategy. For example, MAJ reported that she re-read a paragraph that she could not understand the first time round as it comprised details illustrating relationships between theories,

*'I read this paragraph the first time and noticed that it was explaining the different relationships between theories I could not understand very well (.) therefore (.) I re-read it' (SR)*

Also, REE was observed re-reading confusing sentences in order to comprehend them,

*'She seems confused and re-reads sentences' (Ph2/FN)*

### **3. Using context**

55% of the readers used context to understand specific sentences and words. Half of the readers were solving comprehension problems via using the context rather than focusing on the literal meaning of the words during print-based reading. For example, MAJ stated that she could not understand the meaning of 'feasible' and 'payoff' during reading and she had to read the previous and the following sentences in order to comprehend the global meaning of the words within the sentences,

*'Here I did not understand the meaning of these two words: feasible and payoff, but I usually try to read the sentences and figure out the meaning of the new words from the sentence itself' (SR)*

### **4. Pausing**

100% of the readers paused to solve comprehension problems and process information. For example, AML stated,

*'I read the first feature and I could not understand it (.) I read it again (.) I needed to think about its meaning so I stopped my reading here' (Ph2/SR)*

### **5. Thinking**

Similarly, all the readers allowed themselves time to think when reading specific paragraphs and sentences in order to understand specific information. For example, LAM stated that she needed time to pause during the reading and think about the content in order to comprehend what she was reading,

*'Ok here I read these sentences several times (.) but in the end I needed to stop and think about them' (Ph2/SR)*

### **6. Pointing**

Half of the readers pointed to specific words or sentences to re-focus themselves on the reading text, and track the sentences they are reading. For example, SAJ was observed,

[picking] up the pen again and points to each word in the paragraph] [she writes notes 'by whom?'] What? it is not clear [she points again] (00:37)' (Ph2/TA)

### **7. Ignoring difficult portions**

Ignoring difficult portions of text was a strategy mentioned by only 20% of the readers during the print-based task. For example, RSH declared that she ignored a paragraph that she could not comprehend,

*'I did not understand this paragraph (.) I ignored it ahh (.) I just continued my reading'*  
(SR)

### **8. Translating using hard copy dictionaries**

Surprisingly, none of the readers used a hard copy dictionary to look up meanings of specific words. None of them reported that they do use traditional hardcopy dictionary to translate unknown words. Most readers during print-based reading were focusing to comprehend the text via decoding the sentences and identifying the global meaning of the text rather than finding the literal meaning of individual words.

### **9. Translating electronically**

On the other hand, only 35% of the readers occasionally translated unknown words electronically in order to comprehend; for instance, GAD in the observation below is observed doing just that,

*'< incompetent = [she underlines a specific word] > [she uses the laptop/ types a word into Google/ listens to its pronunciation]'* (TA)

Similarly, LAM was observed using her Smart phone to translate unfamiliar words to solve a comprehension problem,

*'She is using her iPhone to translate a word'* (Ph2/FN)

### **10. Separating text content**

45% of the readers separated ideas in the text that they found difficult to comprehend. For example, LAM separated the content of one paragraph in order to comprehend its ideas,

*'Here I separated this section into two parts (.) the points that make this technique different from the mindfulness strategies and the points that make it similar to the mindfulness strategies'* (Ph2/SR)

Likewise, RSH stated that she divided long sentences that she could not comprehend into sections in order to understand them,

*'Here the sentences are too long. It is difficult to understand so I needed to separate it. I put these two dots to divide the sentence into two halves. This makes it easier for me to understand'* (SR)

## **11. Connecting text content**

On the other hand, 70% of the readers were connecting sections, comparing information from different sections and relating this to earlier or later information from the text in order to solve a comprehension problem. This is exemplified by LAM who was navigating between the papers and connecting the information to comprehend the research article.

### **5.2.2 Print-based SUP sub-strategies**

It was found that during the print-based reading task, the participants employed several kinds of SUP sub-strategies. The data shows that the most used SUP sub-strategies were marking text, taking notes, reading aloud, confirming, pausing, thinking and pointing. In contrast, the least employed SUP sub-strategies were summarising, vocalising electronically, mentally visualising text content, formulating questions, continuing to read, separating sections and reviewing. A list of these strategies is shown below, together with the frequency of occurrence within the data.

1. Marking the text: 289 instances
2. Making a summarising: 18 instances
3. Taking notes: 128 instances
4. Reading aloud: 131 instances
5. Vocalising electronically: 3 instances
6. Formulating questions: 34 instances
7. Paraphrasing: 0 instances
8. Confirming: 147 instances
9. Pausing: 90 instances
10. Thinking: 95 instances
11. Reviewing: 29 instances
12. Separating text content: 37 instances
13. Pointing: 142 instances
14. Continuing to read: 25 instances
15. Mentally visualising text content: 15 instances
16. Connecting text content: 21 instances
17. Changing physical reading position: 35 instances

18. Using computer functions: 0 instance

For further clarification, these results are illustrated graphically in Figure 18, which presents the frequency of use (expressed as a percentage) of different reading support sub-strategies employed by readers when reading printed texts.

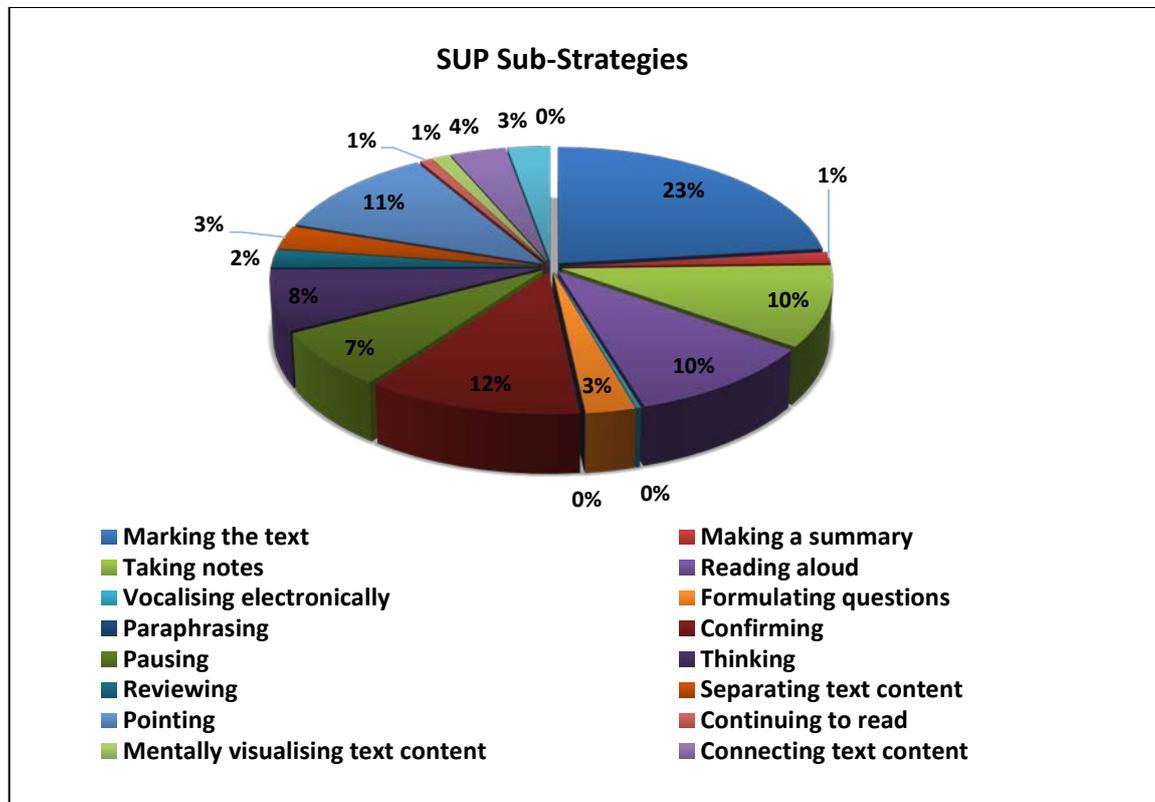


Figure 18: The frequency of SUP sub-strategies employed (on printed paper)

Each of these strategies is exemplified below through statements by readers based on their actual reading experience (see 6.4.1 for further discussion).

### 1. Marking the text

A popular support strategy among all the readers was marking the text, as exemplified by SAJ who declared that underlining and circling specific parts of a text enhanced her concentration and comprehension,

*'Underlining and circling guides me to look directly at specific points when I read next time (.) also they emphasise the information in my mind' (Ph2/SR)*

### 2. Making a Summary

80% of the readers summarised specific parts of the text as they read through it. LAM, for instance, reported doing this during reading important information related to her academic purposes. She mentioned that by doing this she can easily remember and trackback the information from the original source,

*'This information is very important I might use it in my assignments (.) I wrote a summary of it so I can remember and come back to this article' (Ph2/SR)*

### **3. Taking notes**

All the readers were regularly taking notes while reading printed text to support their reading comprehension; AML, for instance, was observed taking notes while reading on-printed paper in order to support her understanding and to facilitate her retention of the written information,

*'Ok here [she follows the sentences with the pen/ includes a specific sentence in brackets/ writes notes/draws a circle around a specific number/ follows the sentence with the pen/underlines a specific sentence] < [she writes notes] = \*\*\* > what? [She writes a note] ok' (Ph2/TA)*

Similarly, LAM was observed taking notes regularly and re-reading the source information during print-based reading to support her reading comprehension,

*'Again here she writes notes and checks what is written in the reading paper' (Ph1/FN)*

In this regard, LAM mentioned that,

*'Taking notes helps me to understand the information' (Ph1/Intvw)*

### **4. Reading aloud**

90% of the readers vocalised specific parts of the text during their print-based reading. For example, AML was frequently heard changing her reading volume between whispering and reading aloud during her print-based reading exercise in order to enhance her comprehension,

*'<° \*\*\* °= [she follows the sentences with the pen =° \*\*\* °] >' (Ph2/TA)*

Also, SAJ was observed employing different reading styles to support her reading comprehension; auditory, verbal and visual via reading aloud and hearing her voice verbalising the written information to enforce her understanding of the text.

*'She is verbalizing what she reads with a low voice' (Ph1/FN)*

### **5. Vocalising electronically**

Only one reader electronically vocalised specific sentences, phrases, or words while reading using a laptop, as exemplified by GAD's reading strategy when she stopped her print-based reading, and typed a word to translate and listen to its pronunciation on her laptop,

*'ahh (00:23) what is this word? [She uses the laptop/types a word/listens to its pronunciation] °°\*\*\* °° [she listens to the word again/writes notes' (TA)*

## 6. Formulating questions

70% of the readers formulated questions while reading to support their comprehension of specific information from the research article. By doing this, they stimulated their cognition to find particular answers. SAJ, for instance, reported asking herself questions while reading,

*'[she picks up the pen again and points to each word in the paragraph][she writes notes 'by whom?'] What? It is not clear (00:37)' (Ph2/TA)*

## 7. Paraphrasing

Surprisingly, none of the readers employed the paraphrasing strategy when engaged in print-based reading. Readers were only engaged with reading for comprehension, while during on-screen reading, some readers were simultaneously read, comprehend and paraphrase specific sentences, paragraphs or/and sections.

## 8. Confirming

On the other hand, all the readers were regularly confirming their understanding by uttering specific words or phrases to support their reading comprehension. For instance, while reading MAJ would say 'ok' and 'two points',

*'01:31 ok < [she circles a specific phrase] = two points >' (TA)*

Similarly, AML was observed reading in the same manner,

*'She keeps saying ok regularly when she reads' (Ph2/FN)*

## 9. Pausing

Similarly, all the readers paused during their text reading. For example, GAD paused regularly during her reading as exemplified by the fact that she paused at one sentence for 00:17, 00:31 and then for 00:08 seconds,

*°°\*\*\* °° > (00:17) °°\*\*\* °° [she underlines a specific phrase] (00:31) < [she follows the line with the pen] = (00:08) < incompetent = [she underlines a specific word] >' (TA)*

Also, AML was pausing consistently to support her reading comprehension,

*'... pauses a lot when she reads' (Ph2/FN)*

## 10. Thinking

All the readers mentioned that they were reading and thinking simultaneously and that sometimes they were reading intensively in order to take in the details mentioned in the text. For instance, LAM explained,

*'Ahh here they presented too many details about the emotion regulation difficulties (.) I was connecting these details together and thinking about them (.) I read this long paragraph I think more than three times (.) I needed to come up with the main idea of all these details' (Ph1/SR)*

### 11. Reviewing

The data also shows less frequently used strategies, such as reviewing, which was used by only 55% of the readers to support their reading comprehension. SAJ stated that she reviewed the main points of specific paragraphs to support her comprehension of the information and to link it to her academic purposes,

*'Here after I read this paragraph I needed to read it quickly for the second time to get a complete idea about it and think how I can relate it to my study'*  
(Ph2/SR)

### 12. Separating text content

50% of the readers also separated sections and/or sentences when reading to enhance their reading comprehension, as exemplified by BDR who reported,

*'I divided this paragraph into three sections to make it easier for myself to comprehend'* (SR)

### 13. Pointing

On the other hand, all the readers were also inclined to point towards specific sentences while reading to track the sentences for comprehension supporting purposes. For instance, AFR was observed pointing and tracking the sentences with her pen while reading,

*'<\*\*\*\* = [she follows the sentences with the pen] > ok that's a description  
< \*\*\*\* = [she follows the sentences with the pen] > (00:10) ok < \*\*\*\* = [she follows the sentences with the pen] \*\*\*\* =/// >'* (SR)

Similarly, REE was observed tracking sentences while reading to enhance her concentration and to support her comprehension,

*'She follows the sentences with the pen while she is reading'* (Ph2/FN)

### 14. Continuing to read

40% of the readers said that they sometimes continue their reading of a text even if they cannot understand all the details included in the text. For example, SAJ stated that by completing reading a section, she supports her comprehension of that specific section,

*'I read this section (.) ahh I did not understand the details here (.) especially at the beginning but here I completed my reading and I got the main idea by the end of this section'* (Ph2/SR)

### **15. Mentally visualising text content**

Only 5% of the readers mentioned using mind mapping to organise ideas cognitively and to comprehend the content of the text, including GAD who said,

*'When I read information that is connected together, such as high social anxiety and low positive interpretation (.) I write about the contradictory relations to explain them to myself (.) for example, here there was high social anxiety but low interpretation. Usually I draw the idea and draw arrows and circles (.) I present the idea as a kind of map' (Intvw)*

### **16. Connecting ideas**

The connecting ideas when reading strategy was employed by all the readers during their print-based reading; LAY, for instance, explained that she made a connection between the written information and the information presented in a table in order to enhance her comprehension,

*'I was trying to connect the information to what I have read in the table (.) then I returned to the table to check the information with what I had read on that page' (SR)*

### **17. Changing physical reading position**

85% of the readers were observed changing their position while reading. REE stated that changing reading position by holding the paper up after spending time reading it on a desk was a support for her reading comprehension as it increases her motivation to read and decreases the feeling of being bored,

*'Sometimes I feel more comfortable to hold it up and read instead of looking down' (Ph2/Intvw)*

#### **5.2.3 Print-based GLOB sub-strategies**

The data gathered in this study reveals that during the print-based reading task the participants employed several kinds of GLOB sub-strategies. The findings show that the most used GLOB sub-strategies were retrieving background knowledge, identifying main ideas, having a purpose, pausing, thinking and connecting ideas. In contrast, the least employed GLOB sub-strategies were locating key words, attending selectively, skipping, anticipating, planning, using text references and scanning. A list of these strategies is shown below, together with the frequency of occurrence within the data.

1. Using visual aids: 32 instances
2. Previewing: 51 instances
3. Locating key words: 22 instances
4. Identifying main ideas: 63 instances

5. Attending selectively: 16 instances
6. Skipping: 23 instances
7. Using background knowledge: 82 instances
8. Anticipating: 8 instances
9. Planning: 8 instances
10. Having a purpose: 68 instances
11. Visualising ideas: 35 instances
12. Pausing: 80 instances
13. Thinking: 79 instances
14. Scanning: 4 instances
15. Using text references: 6 instances
16. Connecting ideas: 81 instances

For further clarification, these results are illustrated graphically in Figure 19, which presents the frequency of use (expressed as a percentage) of the GLOB sub-strategies employed during the print-based reading task.

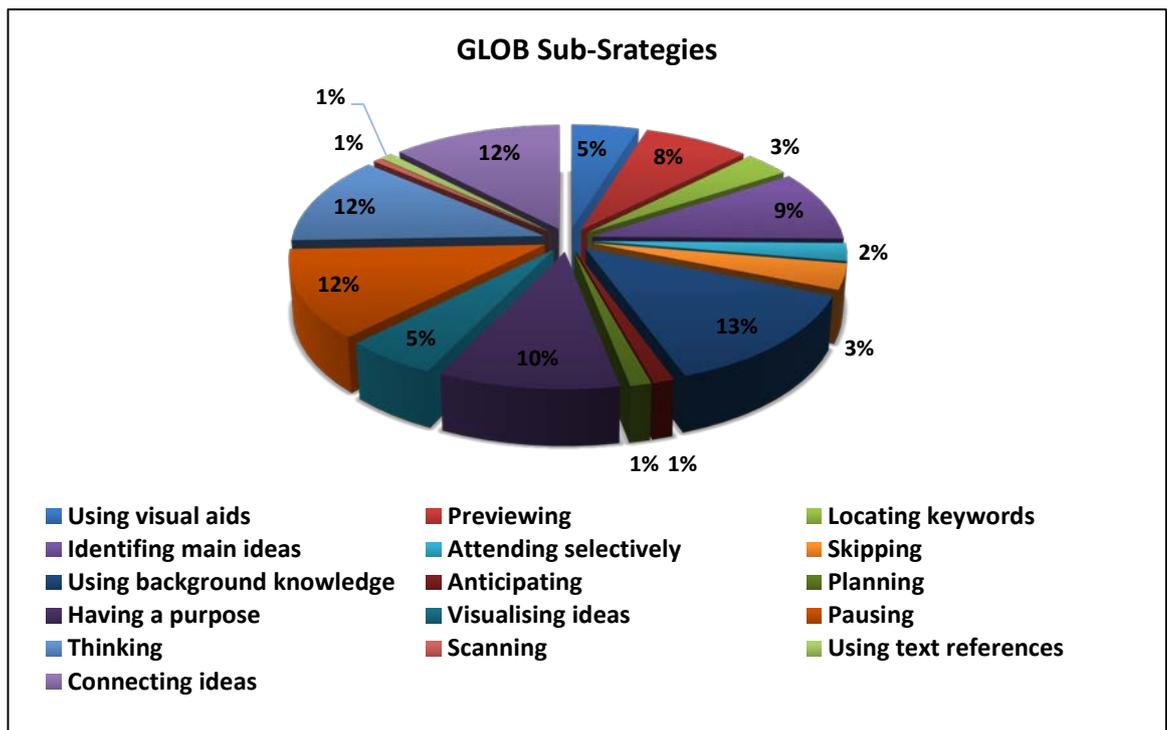


Figure 19: The frequency of GLOB sub-strategies employed (on printed paper)

Each of these strategies is exemplified below through statements by readers based on their actual reading experience (see 6.4.1 for further discussion).

### **1. Using visual aids**

55% of the readers used visual aids, such as graphs, tables and/or figures to enhance their reading comprehension when reading. For instance, SAJ said that she read the figure before reading the text in order to enhance her reading comprehension,

*'I turned the page to read figure one (.) I prefer to look at the figure before reading about it' (Ph2/SR)*

### **2. Previewing**

During their paper reading all the readers were employing a previewing strategy in which they initially read the research article by checking its title, sections, sub-sections and main ideas in order to obtain a general idea about the text before actual reading.

### **3. Locating key words**

80% of the readers spotted key words while reading. For instance, REE explained that she located key words in the abstract of the research article and then marked them. She mentioned that by doing this she obtained a general idea about the research article,

*'Here I read the abstract (.) I was looking for the main ideas and key words in the abstract I circled these key words here (.) and here I underlined important words about the study (.) these helped me to understand the main purpose of the article' (Ph2/SR)*

### **4. Identifying main ideas**

All of the readers identified the main idea of specific sections and/or paragraphs in the text; for instance, LAY said that she focused on the main ideas,

*'I looked for the main information in the abstract (.) here my eyes went directly to the aim of the paper' (SR)*

### **5. Attending selectively**

Only 50% of the readers typically selected specific sections to read when reading print-based text to meet their academic reading purposes and to save their time. For example, MAH stated that she was searching for a specific part (the results) of the research article to read,

*'Actually here I was searching for the results page and here it is (.) but here they wrote these points one, two, and three; I needed to read them so I read the paragraph that came before the points to understand why they included them' (Ph2/SR)*

## 6. Skipping

Skipping was employed by only 30% of the readers, as readers during the print based reading task were reading printed text mostly in a linear style, for instance, RSH said that she skipped details that she did not need for her academic purposes,

*'I did not read these details (.) they are too in depth, I do not need them (.) ahh I preferred to continue on and read the next paragraph' (SR)*

## 7. Using background knowledge

Additionally, all the readers used their background knowledge during reading to comprehend the text, thinking about and connecting the information that they read in the text with their previous knowledge. For instance, GAD explained she was comparing the present text to previous research articles that she had read,

*'I was explaining to myself that here the study was comparing this kind of study and the other kind of the study that they used (.) here I categorised each study and wrote about the type of study (.) the first here was a scenario, the second one a paradigm, and the last one a sentence' (SR)*

## 8. Anticipating

45% of the readers used anticipation strategies when reading print-based texts. For example, MAH reported that she anticipated and thought about the content of the text by reading its title and abstract,

*'Because when I read the title and the abstract (.) I realised it was about classroom management (.) I expected that it may contain information about classroom management and teachers' punishment of students (.) I think this will help me in my assignment' (Ph2/SR)*

## 9. Planning

60% of the readers initiated their reading of the text by formulating a plan for their reading process. For example, MAJ had a plan about how she was going to approach the text in order to comprehend it. She mentioned that first she was going to read the text to obtain a general idea about its content, then she would read the main ideas of each paragraph, and finally she would re-read the whole article.

*'First I will read the paper to learn about its content. Then I will read the beginning and the end of each paragraph, because in most paragraphs, the main idea appears in the first sentence and the summary in the last one ahh then I will read the entire article again' (SR)*

## 10. Having a purpose

In addition, the data shows that all readers read with a specific purpose in mind. For example, AFR said that she meant to read the methodology as her main purpose of the reading was to understand the procedure of the research study that she was reading rather than reading and comprehending the background and the literature review of the research article,

*'I jumped to the methodology section, because I did not need to read the literature review of the paper (.) I know about the topic in general and I only needed to know about the study'* (SR)

Similarly, MAH was observed searching for definitions of specific concepts,

*'The purpose of her reading is to find specific information about her topic'*  
(Ph2/FN)

## 11. Visualising ideas

65% of the readers cognitively imagined some of the ideas behind the text and the specific parts of the text; for example, RSH said that she was forming a mind picture about the study that she is reading and visualising the whole picture in relation to other research articles that she has read in relation to her academic purposes,

*'I tried to create a picture in my mind about this study and the others and see everything at once in my thesis'* (SR)

## 12. Scanning

Just 15% of the readers employed scanning the text in the print-based reading task to search for a specific detail. For example, REE mentioned that she was focusing to find and read only specific information,

*'Ok here I was just trying to get an idea about the information (.) ahh here's the discussion (.) ahh I am not very interested in this information but I feel that it is important to know what they have (.) so I read fast here to get an idea about the content of the discussion part (.) I was focusing to find and read this specific information'* (Ph2/SR)

## 13. Using text references

In addition, 35% of the readers used the references to support their reading. That is, they were reviewing the references in the text in order to increase their reading comprehension by increasing their knowledge in a specific area. For instance, LAM said that she recorded some of the references in her notes in order to search for and read them at a later point,

*'I wrote down the references for these studies because I want to return to them later on (.) I write them down to remind myself later'* (Ph1/SR)

#### 14. Connecting ideas

Furthermore, 60% of the readers were connecting ideas during their academic reading. That is, they reported that there are links between the information in the paragraphs and the sentences, or between the information that is written in the paragraph and the charts used.

#### 5.2.4 Print-based CRT sub-strategies

Finally, the analysis of the sub-strategies readers used in the critical reading strategies category during the print-based reading task revealed a number of critical reading strategies. It is important to note that during the print-based reading task readers did not employ critical reading strategies extensively. A list of these strategies is shown below, together with the frequency of occurrence within the data.

1. Evaluating the information: 74 instances
2. Evaluating the source of the information: 20 instances
3. Evaluating the language: 18 instances
4. Evaluating the style: 17 instances

For further clarification, these results are illustrated graphically in Figure 20 to present the frequency as a percentage of each of the critical sub-strategies utilised when reading.

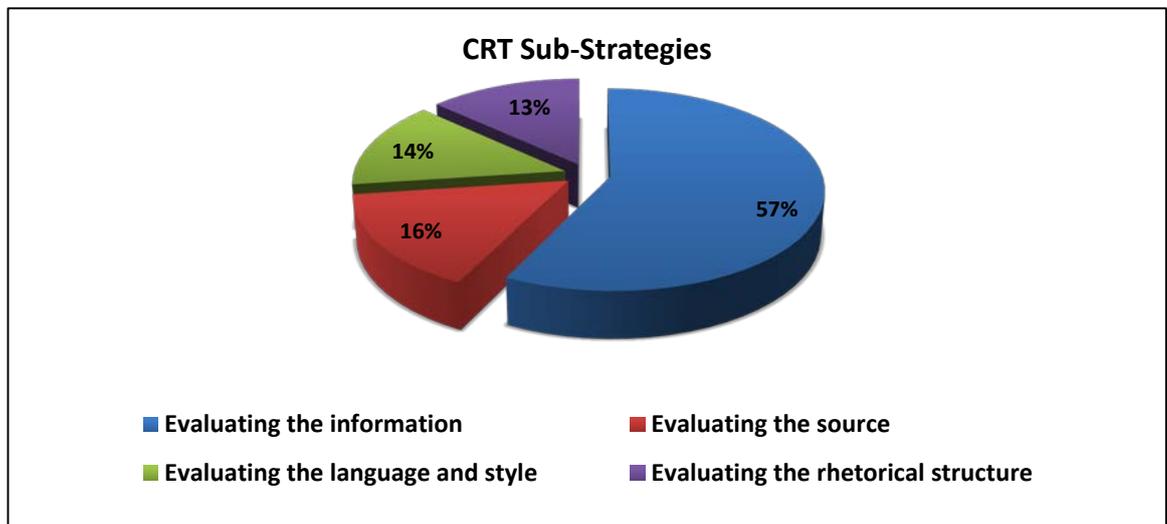


Figure 20: The frequency of CRT sub-strategies employed (on printed paper)

Each of these strategies is exemplified below through statements by readers based on their actual reading experience (see 6.4.1 for further discussion).

### 1. Evaluating the information

80% of the readers evaluated the information, such as thinking about the author's reason for using a specific method to comprehend and to think about the text critically. For example, REE was critically evaluating the content of the research article in which the author had not explained and justified the methods that he/she had employed in the study,

*'In the paper they did not include clear information about why they used this test in particular (.) they didn't say anything about normal distribution ahh for example if they used it or not and why they chose this test (.) they did not include this information (.) they talked about the validity of the test but did not test the validity and the reliability' (Ph2/SR)*

### 2. Evaluating the source

Similarly, 65% of the readers evaluated the source of the text before or when reading the text to enhance their global comprehension of the text. For example, MAH reported that she first read information about the author of the study and then the country, in which it took place,

*'Here I first read information about the authors and where the study occurred (.) the thing that attracted my attention was that the study was conducted in a Saudi University and my assignment is about Saudi students' (Ph2/SR)*

### 3. Evaluating the language and style

55% of the readers evaluated the language of the text they were reading; for example, AML evaluated the level of the language used, the syntactic structure of the sentences and the style, such as the use of repeated information,

*'This paper is clear and easy to read (.) ahh the structure of the sentences is clear (.) I could follow the paper easily (.) but in that paper I noticed that the writers were repeating information' (Ph2/SR)*

### 4. Evaluating the rhetorical structure

60% of the readers also evaluated the rhetorical structure of the text; for instance, MAH stated,

*'Also here the literature review did not include subtitles (.) this made it very difficult to read and understand (.) I feel that subheadings give me a clue about what groups of paragraphs include and their main ideas (.) but when I find a paper arranged in this way (.) it is very difficult for me to read and understand' (Ph2/SR)*

The data that was analysed and presented in the previous sections concerning the print-based reading strategy categories, sub-strategies and their frequency is discussed in detail in 6.2.1. The following section presents the challenges that readers experienced during print-based reading.

### 5.3 Print-based reading challenges encountered by L2 academic readers

During print-based reading tasks, readers experience multiple reading challenges. 45% of the readers observed that they had difficulties comprehending unfamiliar words while reading. For example, LAY noted that she could not understand the word 'sobering',

*'This word sobering (.) I could not understand its meaning' (SR)*

20% of the readers commented on difficulties that they experienced comprehending complicated ideas when presented in complex and passive sentences; for instance, SAJ said that she found long sentences difficult to comprehend and needed to concentrate,

*'The sentence is long and contains several ideas (.) I need to read it slowly and carefully' (Ph1/SR)*

35% of the readers mentioned that the structure of the paper caused comprehension difficulties. For example, ALA stated,

*'I don't understand them because some of the papers have no methodology section, and the methods they use form the whole paper' (Intvw)*

20% of the readers mentioned retention as a notable challenge encountered when reading print-based texts; for example, AML stated that,

*'I experience difficulties remembering the information. I am reading lots of information daily but I cannot remember it all and sometimes I need to re-read the paper or the information' (Intvw)*

10% of the readers reported that they find it challenging to read in a noisy environment, this causes them to lose concentration and become distracted during the reading task.

45% of the readers declared that they find it challenging to read a pre-determined chunk of text in a short time. They characterised themselves as slow readers. As SAJ put it,

*'I needed to read each line and then stop to think about the idea in it (.) here I needed to concentrate more because of the noise outside (.) ahh I cannot read and focus when there is any noise' (Ph1/ SR)*

50% of the readers stated that reading texts containing unfamiliar information is also a challenge. For example, AML reported,

*'I also read the last four lines several times (.) the idea was not clear (.) actually I have not read this kind of information before this is my first time (.) ahh I could not understand it' (Ph1/SR)*

15% of the readers also struggled to comprehend statistical information when reading printed texts. For instance, REE stated,

*'Here most of the information relates to statistics and I am not very good at statistics, so I cannot understand the information exactly'* (SR)

45% of the readers also stated that they found it challenging to think critically and employ critical reading strategies when reading in print. This was exemplified in ALA's reply,

*'Also, sometimes I find it difficult to connect studies (.) I find it very difficult to compare studies and evaluate them in relation to each other'* (Intvw)

These findings are compared and contrasted with on-screen reading challenges (presented in 4.7); and discussed in 6.4.2. The differences and the similarities of the reading processes, functional strategies and sub-strategies between the two reading formats; print and on-screen are revealed and elucidated in the following section.

## **5.4 Differences and similarities between print-based and on-screen reading**

### **5.4.1 Differences and similarities in reading processes**

The data presented in 4.5 and 5.2 showed that readers approached on-screen texts using bottom-up processing and, to a lesser degree, top-down processing. However, during this process, top-down processing was mainly used to evaluate the relevance of the text and its connection to academic purposes. On the other hand, when approaching texts in a printed paper format, readers tended to rely equally on both processes. These findings show that these two reading processes are activated during the two reading formats; paper and on-screen. However, the frequency of use of the two reading processes differs. For further clarification, these results are illustrated graphically in Figure 21, which presents the frequency of the types of reading approaches employed by the postgraduate readers in relation to the two reading formats.

(Continued overleaf)

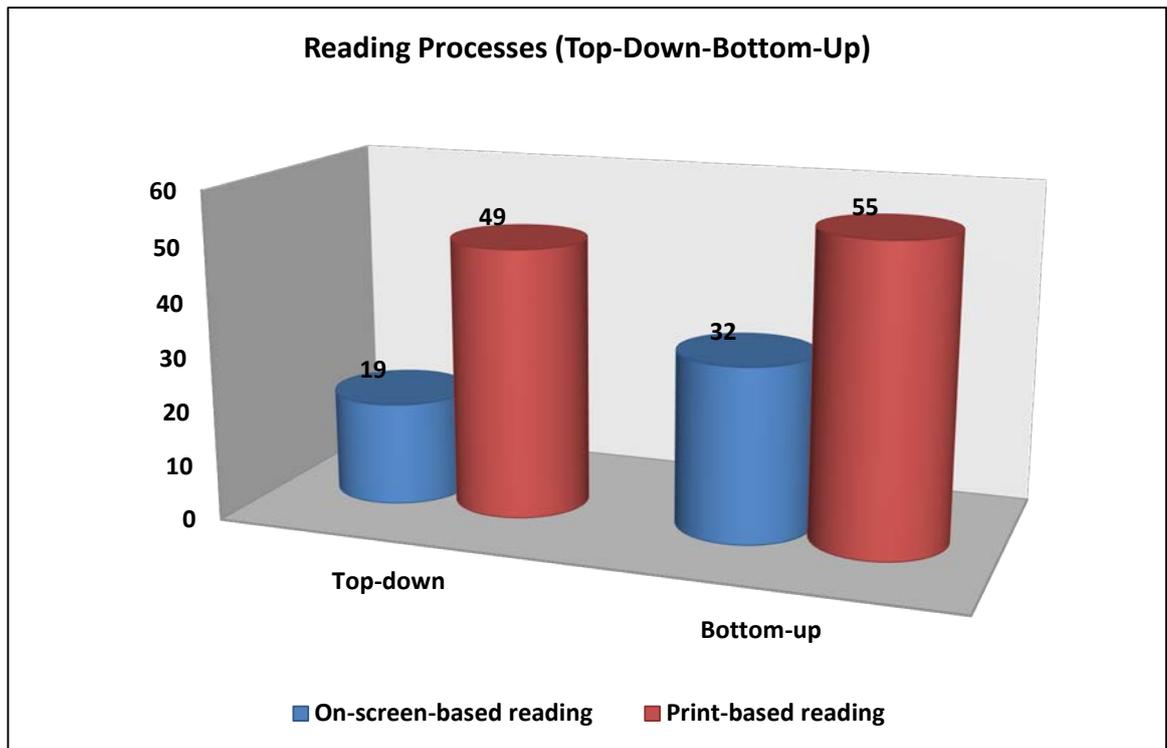


Figure 21: Comparing the employment of the two reading processes (top-down and bottom-up) between the two reading formats (on-screen versus print)

The means of both types of reading processing demonstrate that the readers were relying more on bottom-up (mean = 32) than top-down (mean = 19) processing while they were reading on-screen texts. On the other hand, during print-based reading, readers employed approximately the two approaches equally, (Top-down mean = 49) and (Bottom-up mean = 55), (see 6.4.1 for full discussion).

#### 5.4.2 Differences and similarities in functional reading strategy categories

In both reading formats; print and on-screen, readers used a wide repertoire of the same strategies: PROB, SUP, GLOB and CRT (see 4.2 & 5.2). The frequency of use of each of these types of strategy differs in relation to the two formats. A comparison between the frequencies with which various reading strategies were employed during on-screen and on paper reading revealed that all four types of strategy i.e. PROB, SUP, GLOB and CRT were used more frequently when reading on paper than when reading on-screen. It can be seen from Figure 22 that during on-screen reading, participants employed fewer strategies than when reading on paper.

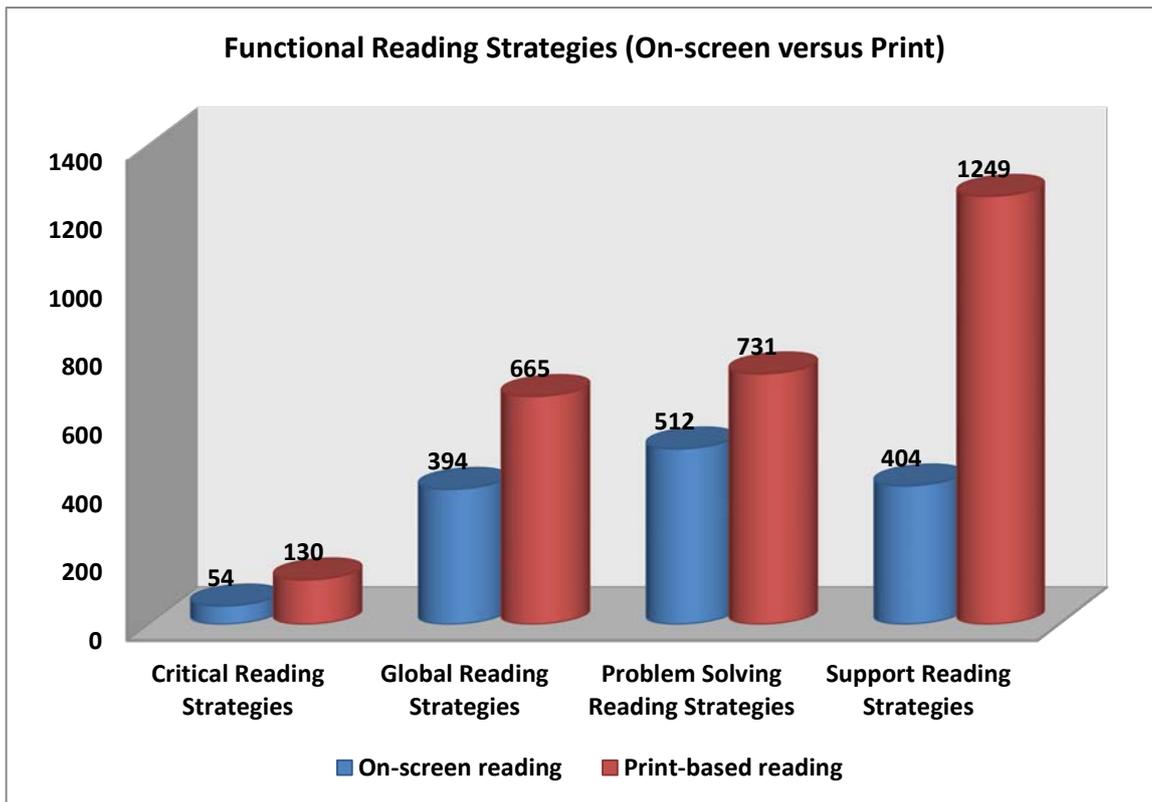


Figure 22: Functional reading strategies – number of instances (on-screen versus print)

Readers employed support reading strategies during their paper reading to a far greater extent (1249) than they employed them during their on-screen reading task (404). Similarly, problem-solving strategies were employed twice as much during the paper reading task (731) as during the on-screen reading task (512). Moreover, readers' use of critical reading strategies when on-screen reading was much less (54) than when they were reading text on paper (130). There was also a slightly higher use of global reading strategies during the paper-reading task (665) than the on-screen reading task (394).

### 5.4.3 Differences and similarities in sub-strategies

#### 1. PROB sub-strategies

It is interesting to note that the findings suggest that there are differences in the strategies typically employed while reading on-screen and reading printed paper (see 4.2.1 & 5.2.1). The analysis of the PROB sub-strategies revealed that readers employed them more frequently during their paper reading task than during their on-screen reading task. These differences are discussed in 6.2.1. For further clarification, these results are illustrated graphically in Figure 23, which presents the frequency with which PROB sub-strategies were employed in the two formats.

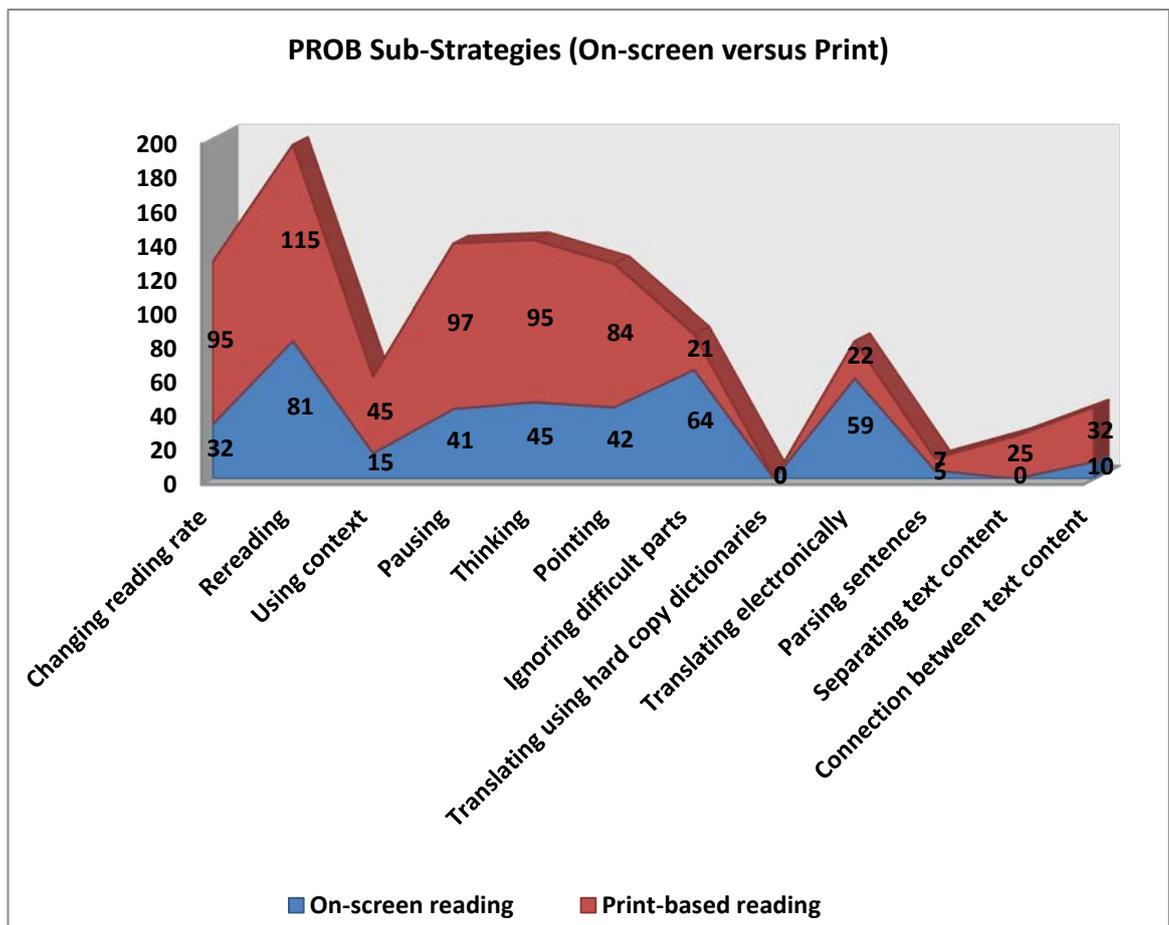


Figure 23: Problem-solving sub-strategies – number of instances (on-screen versus print)

Readers changed their reading speed, used strategies such as re-reading specific sections, pausing and thinking more frequently during print-based reading than on-screen reading. However, they were more likely to ignore difficult sections and look up the translation of words electronically during their on-screen reading than during their print-based reading task. Readers did not refer to hard copy translations of words when reading in either format.

## 2. SUP sub-strategies

The readers employed SUP sub-strategies more frequently during print-based reading than on-screen reading (4.2.2 & 5.2.2). For further clarification, these results are illustrated graphically in Figure 24, which presents the frequency with which various SUP sub-strategies were employed in the two different reading formats.

(Continued overleaf)

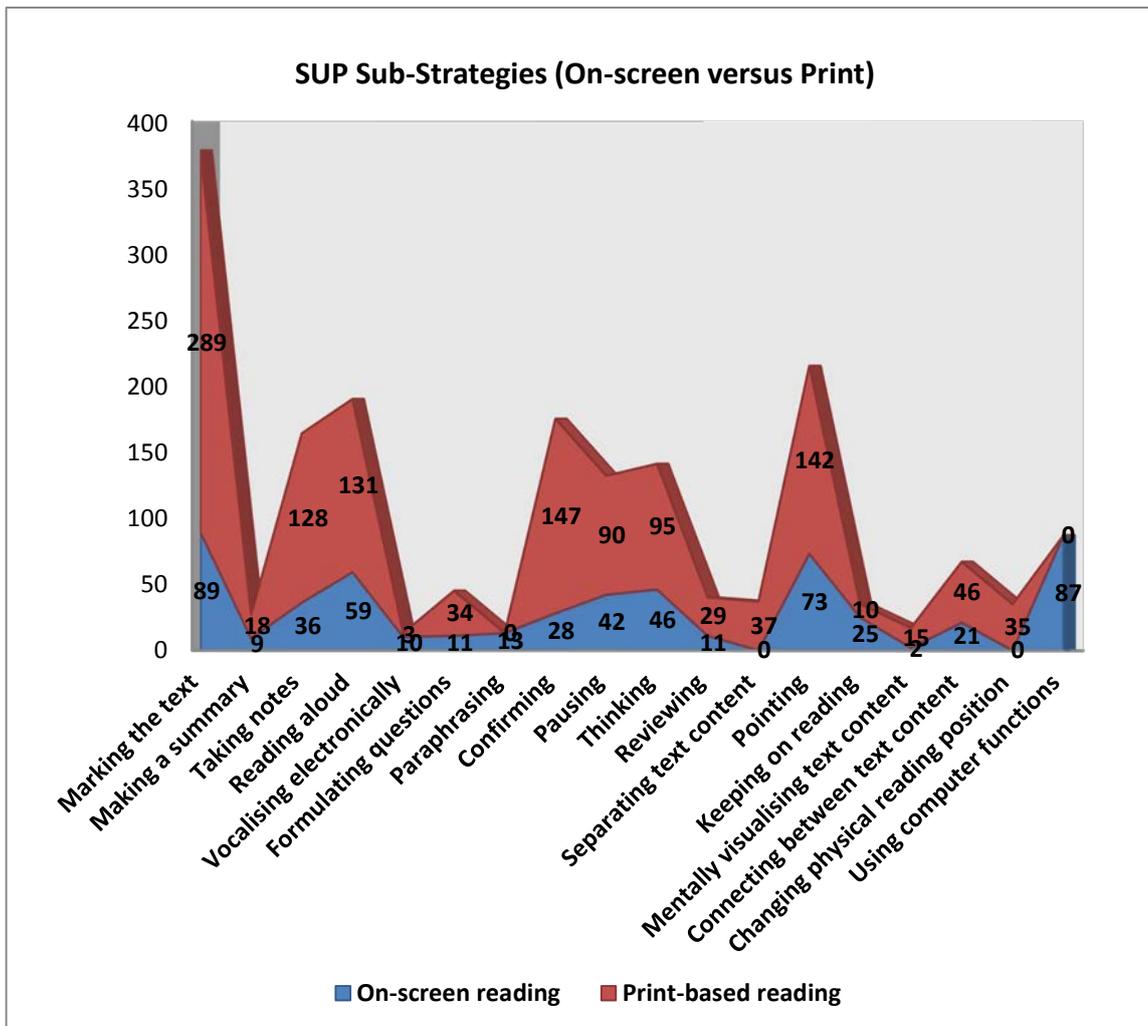


Figure 24: Support sub-strategies – number of instances (on-screen versus print)

Support reading strategies were used less frequently during on-screen reading than during paper reading. Readers marked the text, took notes, pointed, paused, separated sections, reviewed, formulated questions, connected ideas, confirmed and vocalised more frequently during their paper reading task than during their on-screen reading one. On the other hand, readers paraphrased, summarised, ignored difficult parts and vocalised ‘electronically’ more frequently during their on-screen reading task than during their print-based reading one. There are a few sub-strategies that were employed in only one of the reading formats, for example, changing reading positions was only applied while reading the paper, while digital activities were only applied during on-screen reading. Another sub-strategy that has been employed during print-based reading only is separating sections. The readers were sometimes separating sentences or paragraphs in order to support their reading comprehension. However, other readers reported that they separated sentences as they found them too complex to understand. In the latter case therefore, they separated the sentences in order to solve a reading problem.

### 3. GLOB sub-strategies

A comparison between the applications of the sub-strategies of the GLOB category in the two text formats indicates that some of the GLOB sub-strategies were employed more often during the print-based reading task than the on-screen reading task, while other strategies were more frequently employed during the on-screen reading task than during the print-based reading one (see 4.2.3 & 5.2.3). For further clarification, these results are illustrated graphically in Figure 25, which presents the differences in the frequency with which the GLOB sub-strategies were used in the two reading formats.

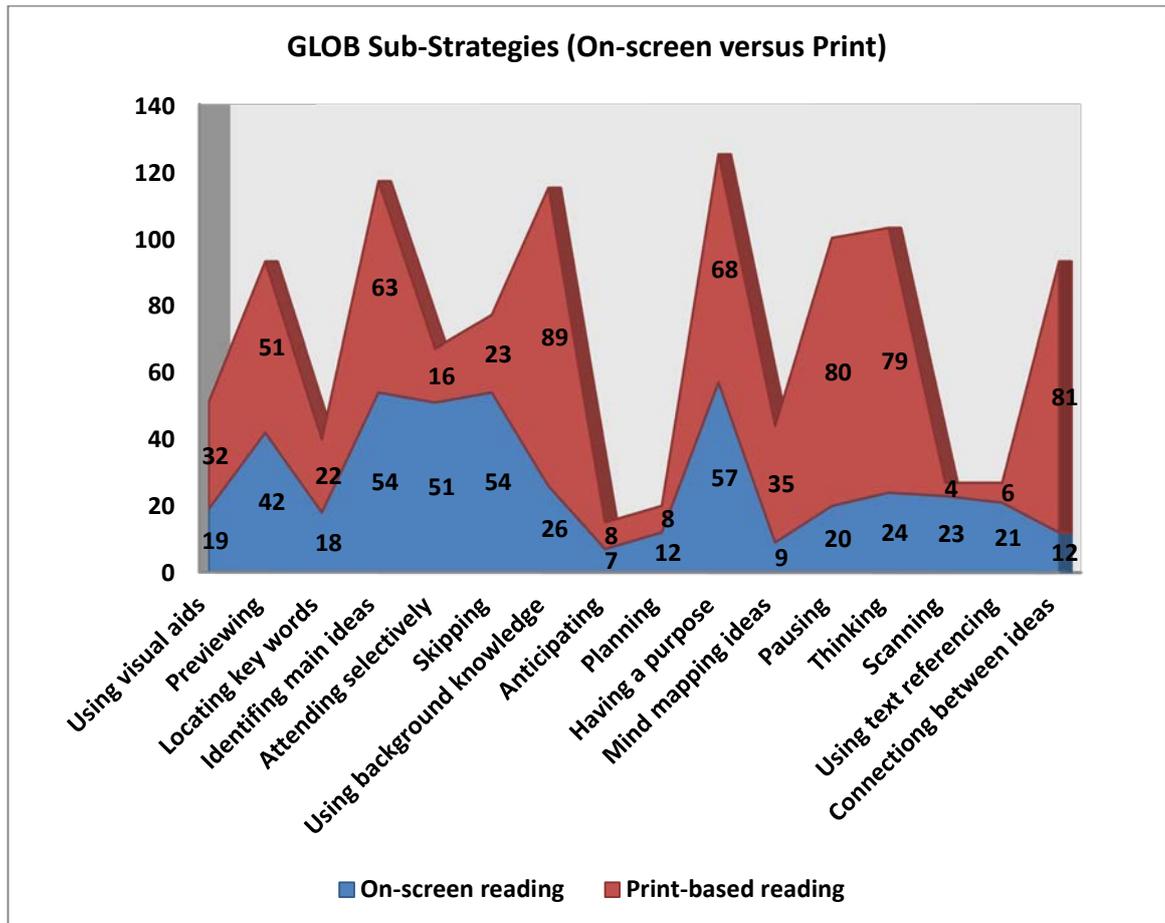


Figure 25: Global sub-strategies – number of instances (on-screen versus print)

Readers used strategies such as using references, using visual aids, skipping, scanning and ignoring difficult parts, more frequently during their on-screen reading task than during their paper reading task. By contrast, readers employed the background knowledge strategy, pausing, thinking and connecting ideas during the print-based reading task more frequently than the on-screen reading task. This reinforces the conclusion that readers tend to use on-screen reading only as a means of checking information relevant to their academic purposes. Thus, they ignore difficult and detailed passages and do not attempt to use strategies to understand them. Readers

also use visual aids to help them understand the main ideas of the text, without spending much time reading the detailed information.

#### 4. CRT sub-strategies

The analysis of the use of sub-strategies of critical reading clearly revealed that readers applied these sub-strategies more frequently during their paper reading task than during their on-screen reading task (see 4.2.4 & 5.2.4). For further clarification, these results are illustrated graphically in Figure 26, which presents the frequency with which the CRT sub-strategies were applied to the two reading formats.

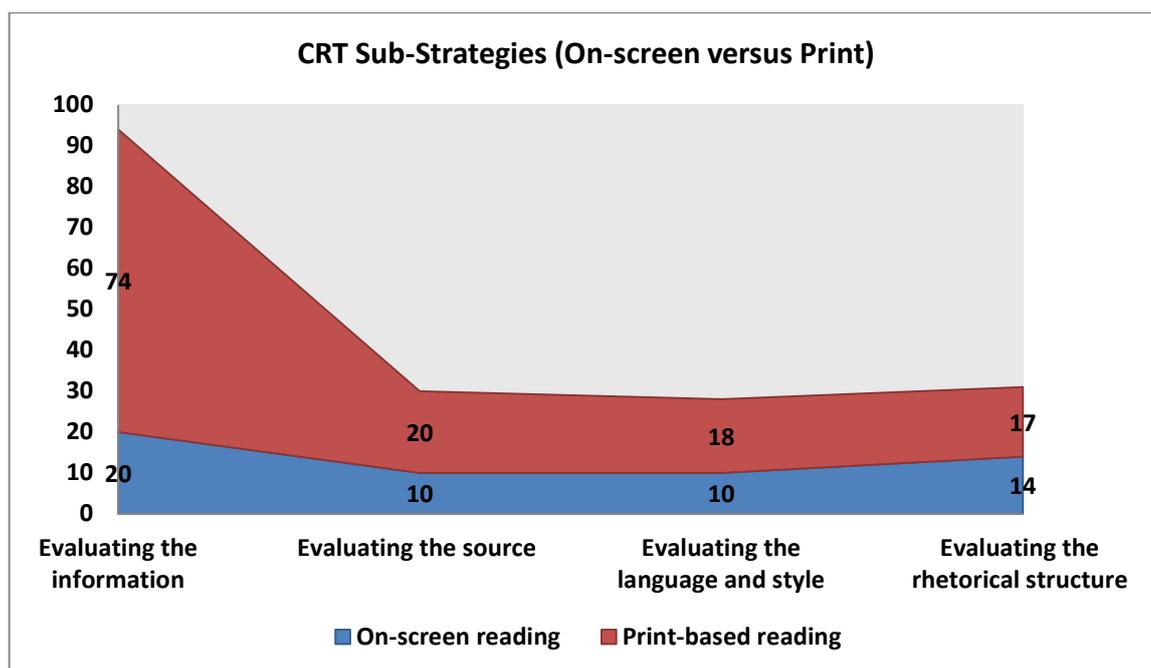


Figure 26: Critical sub-strategies – number of instances (on-screen versus print)

Readers observed the style and the language of the text and evaluated the sources and the information given more frequently during their paper reading task than during their on-screen reading task. This indicates that they read the text presented in hard copy more critically than they read text presented on-screen.

Having analysed and presented on-screen and print-based reading processes, functional strategies, sub-strategies and reading challenges, the next chapter discusses academic readers and L2 reading in the 21<sup>st</sup> century. It puts the spotlight on the new proposed aspect of on-screen reading, namely digital academic strategy literacy (DASL) and situates current readers' knowledge and actual practice of it.

## Chapter 6: **Academic readers and on-screen L2 reading in the 21<sup>st</sup> century**

### **6.1 Introduction: reviewing data and research questions**

The present chapter provides a discussion of the findings presented in the previous data chapter according to the research questions that are presented at the end of this section. Section 6.2.1 examines the reading strategy categories employed by the readers and discusses them in terms of their consistency with previous research. This allows a conclusion to be drawn regarding the types of reading strategy categories and sub-strategies that postgraduate readers use most and least often. It also allows for interpretation of the use of these strategies and discusses the findings that on-screen texts required readers to utilise different sorts of functional reading strategies to achieve comprehension which include: global (GLOB), problem-solving (PROB), support (SUP) and critical (CRT) strategies.

This is followed by a discussion in 6.2.2 of how the strategies employed by the readers operate in terms of top-down and bottom-up processes and a description of the nature of this interaction in which it was found that on-screen L2 academic reading is an interactive process, comprised of both top-down and bottom-up processes. However, as previously presented in 5.4.1, during on-screen reading, participants interacted with the text more through bottom-up processes than top-down processes as a consequence of their on-screen reading purposes.

The categorisation of the sub-strategies used to interact with various levels of text content on-screen is discussed in 6.2.3. This is followed in 6.2.4 by a discussion of the digital affordances utilised by the participants in order to comprehend texts, illustrating the process of utilising these e-resources and the reasons behind their use. Interestingly, on-screen reading allows for the use of e-resources concurrently with the reading process. However, readers' utilisation of these digital affordances was low, which leads to various implications for enhancing student readers' on-screen academic reading, which are discussed the next chapter (see 7.3).

In section 6.3, the data explained in 4.7 concerning challenges facing L2 academic readers when reading text displayed on-screen are discussed. The findings demonstrate the various challenges affecting L2 on-screen readers when reading digital texts. Strategies that readers employ in order

to overcome these challenges were discussed in 6.3.5. However, most readers were not aware of backup tools that could be used to assist with several reading comprehension problems, such as speeding up their reading, annotating or having a sense of using paper while reading on-screen. As the capabilities to solve on-screen reading comprehension problems are part of digital strategy literacy, these results may indicate that the readers under investigation are not sufficiently digitally literate in these specific aspects of digital academic strategy literacy.

6.2.1 presents a detailed comparison between print-based reading and on-screen reading, including the employed reading strategies is provided along with the presentation of the results, revealing the frequency of employment of each of the reading strategy categories and sub-strategies as well as the number of readers who used each of the sub-strategies (see 5.2 for print-based reading data). The frequency of employment of each of these different types of reading strategy categories and sub-strategies during the on-screen reading comprehension task varied. Forty-five different types of sub-strategies were identified from twenty readers, including 1,364 total instances of use during on-screen reading (see Table 8). However, it was found that print-based reading required much more use of the same four functional reading strategies than on-screen reading as presented in 5.4. Out of twenty readers, a total of 2,775 recorded instances of sub-strategy were used during print-based reading.

<b>Reading comprehension strategies</b>	<b>On-screen reading strategies (number of instances)</b>	<b>Print-based reading strategies (number of instances)</b>
SUP sub-strategies	404	1,249
PROB sub-strategies	512	731
GLOB sub-strategies	394	665
CRT sub-strategies	54	130
<b>Total</b>	<b>1,364</b>	<b>2,775</b>

Table 8: Instances of on-screen reading strategies versus print-based reading strategies

These differences and the high use of strategies during print-based reading and the low use of strategies during on-screen reading that are presented in 5.4 and the nature of print-based reading that are presented in 5.2; all discussed fully in 6.4. Then, the discussion elaborates on the differences in outcomes between reading on-screen and on paper. This leads to a discussion of the challenges involved in reading on-screen and in print in 6.4.2. Finally, reading components of on-screen and print-based are discussed in 6.4.3.

The four sources of data in the study demonstrated that on-screen and print-based reading shared several similarities but were different in other aspects, such as reading strategy categories, sub-strategies, processes and challenges. Concerning the differences between on-screen reading and print-based reading, this study found that reading in both formats requires both types of cognitive processing, various strategy categories, and various sub-strategies. However, the major

difference between on-screen reading and print-based reading is readers' interaction with text and the use of the digital affordances. Although it was found that on-screen reading can involve a wide range of affordances that facilitate and enhance reading comprehension, readers may interact with on-screen texts in the same way they interact with print-based texts and not make use of these e-resources. This may detract from the value of on-screen reading, which they may only use for limited, superficial purposes, such as searching for specific information, previewing, and skimming, while reading critically is generally reserved for printed text.

The chapter then discusses the possible effects of reading in different disciplinary areas. Three case studies are presented in 6.5.1. The possible effects of individual differences are discussed through two different case studies in 6.5.2, and the effects of previous reading practices and contextual factors are discussed in 6.5.3, followed by the effect of length of study through a comparison of Master's students in Ph1 and Ph2; and Ph1 Master's students and PhD students (see 6.5.4 for a discussion).

Thus, the following sections aim to increase our understanding of on-screen reading and DASL; and discuss the research findings by relating them to the present study's research questions. These are restated below (see cross reference for discussion of the results of each of the main and sub-questions).

### **Research question one (RQ1)**

1. What is the nature of the on-screen L2 academic cognitive reading strategies used by postgraduate students in the UK educational context when reading research articles in their field of study? (see 6.2)
  - a. What types of on-screen functional reading strategies do L2 readers use, and with what frequency? (see 6.2.1)
  - b. What types of on-screen sub-strategies do L2 readers use, and with what frequency? (see 6.2.1)
  - c. What is the nature of on-screen reading processes in terms of bottom-up and top-down approaches? (see 6.2.2)
  - d. Do L2 readers use different sub-strategies to deal with different parts of on-screen text, and, if so, what are they? (see 6.2.3)
  - e. What types of technological benefits (digital affordances) do L2 readers take advantage of when reading on-screen, and with what frequency? (see 6.2.4)

- f. What is the nature of the academic on-screen reading challenges faced by postgraduate L2 readers of English in the UK educational context when reading a research article in their field of study? (see 6.3)

## **Research Question two (RQ2)**

2. What are the similarities/dissimilarities between on-screen reading and print-based reading? (see 6.4)
  - a. What are the similarities/dissimilarities in strategy type and use (frequency) when reading on-screen and print-based academic text? (see 6.4.1)
  - b. What are the similarities/dissimilarities of reading comprehension challenges between on-screen and print-based academic reading? (see 6.4.2)
  - c. What are the similarities/dissimilarities of reading components between on-screen and print-based academic reading? (see 6.4.3)

The following section discusses the findings of the study pertinent to the nature of on-screen L2 academic cognitive reading comprehension strategies (types of on-screen reading functional and sub-strategies used by postgraduate students and with what frequency in the UK educational context when reading research articles in their field of study (RQ1a and b)).

## **6.2 The nature of on-screen L2 academic reading (RQ1)**

### **6.2.1 On-screen functional reading strategy and sub-strategies (RQ1a & RQ1b)**

In relation to RQ1a and RQ1b (What types of on-screen functional reading strategies do L2 readers use, and with what frequency?) and (What types of on-screen sub-strategies do L2 readers use, and with what frequency?), the findings demonstrate that on-screen readers employ different categories of strategies; e.g. Global (GLOB), Problem-solving (PROB) support (SUP), and critical (CRT) strategies while reading on-screen. Readers' use of problem-solving strategies during their on-screen reading far exceeded their use of the other strategies available. These strategies, such as electronic translation, ignoring difficult sections and re-reading, served as basic mechanisms to aid on-screen reading comprehension. Support reading strategies served as the second main strategies employed and global strategies were the third category of strategies used by on-screen readers to comprehend texts. However, readers do not read deeply and critically, instead interacting with digital texts via lower level processing, such as ignoring difficult sections and translating, more frequently than higher level processing such as evaluating the content of a text. The data shows that most readers were mainly reading on-screen to assess the relevance of the text for their academic purposes. In this case, they were employing sub-strategies that

enabled them to do so, such as skipping, identifying main ideas, attending selectively and previewing during on-screen reading.

The findings presented in chapter 4, 4.2 reveal that readers were digitally academic strategy literate as they were able to interpret information on-screen. 90% of the readers were aware of the strategies that could be employed to deal with on-screen text at a surface level. They also had a procedural knowledge of how, when and why to employ these strategies. All these capabilities represent some aspects of readers' DASL. However, readers were not sufficiently aware of how to be digitally literate during on-screen reading in order to make use of most of the e-resources that could enhance their ability to overcome reading comprehension problems and to understand the text fully.

The results presented in 4.2 are consistent with previous research studies that have found that most on-screen readers employ different categories of strategies; e.g. Global (GLOB), Problem-solving (PROB) and support (SUP), while reading on-screen (Ramli et al. 2011; Amer et al. 2010; Huang et al. 2009; Zaki et al. 2009; Vaez Dalili & Tavakoli 2013; Poole 2008). The findings of the current study, like previous ones, prove that when reading on-screen, readers incorporate different strategies to support, problem-solve, global and critically read; readers are flexible in their selection of strategies. These studies are also consistent with the results of the current study which found that the utilisation of different strategies differed by amount (Ramli et al. 2011; Amer et al. 2010; Huang et al. 2009; Zaki et al. 2009; Vaez Dalili & Tavakoli 2013; Poole 2008).

In the present study, readers' use of problem-solving strategies during their on-screen reading corroborates Anderson's (2003) study findings and his discovery that problem-solving strategies constitute the majority of the strategies utilised during on-screen reading. Huang et al. (2009) found that students used more localised strategies, in particular translation, when reading on-screen than they did other sorts of strategies. Similarly, Poole (2008) found that problem-solving strategies were used with high frequency during on-screen reading.

However, Konishi (2003), presented contrasting findings, revealing that both supportive and global strategies are heavily employed by readers during on-screen reading. In addition, Ramli et al. 2011, and Zaki et al. (2009), found that global strategies are most commonly used by on-screen readers, followed by problem-solving strategies and support strategies. Zaki et al. (2009) also asserted that readers use global reading strategies more frequently during on-screen reading, because of the nature of e-text, which enables readers to navigate and use e-resources, such as

audio and video clips to assess text relevance to their academic purposes and to enhance comprehension.

It appears that the readers in the current study mostly depended on problem-solving strategies to facilitate their on-screen reading comprehension. The dominant use of PROB is a consequence of readers only aiming to achieve superficial and instant comprehension of the text to determine usefulness. Thus, the participants mostly utilised lower level strategies to interpret the main ideas in texts, including comprehending L2, and avoided in depth comprehension of the information. This result is consistent with many other studies, which agree on the shallow nature of on-screen reading (University College of London 2008; Cull 2011; Carr 2010; Liu 2008; Coiro & Dobler 2007). It reveals that the initial stage when reading an on-screen text is more about problem-solving techniques than uncovering means to support global meaning or being critical, particularly for L2 readers.

Support reading strategies, such as highlighting, pointing, re-reading and vocalising served as the second main strategies employed by on-screen readers to comprehend texts. More specifically, readers were reluctant to employ re-reading strategies in the current study - this could be because they were reading in their L2, which demands more attention and focus than reading in L1 (certainly in the case of attempts to understand the surface level of the text). In terms of highlighting strategy, the results of the present study match those of earlier studies (Park & Kim 2011; Huang et al. 2009; Margolin et al. 2013), which found that readers highlight specific written texts during on-screen reading. However, a study conducted by Liu (2005), found that during on-screen reading, readers are unlikely to highlight, as they experience difficulties annotating on-screen. One explanation for the contradiction between the previous studies mentioned and the results of the current study, is that change is rapid; students are becoming more fluent in technology, and so are more familiar with reading and editing texts on-screen, and better equipped to utilise strategies on-screen than those a mere decade ago.

However, the findings of the current study reveal that the majority of the readers highlight text, but do not take notes while reading on-screen. One participant reported that she takes notes on the article itself. Very few reported that they use specific software that enables them to take notes about an article and few take notes electronically in a separate electronic sheet, such as a Word document. Most of the participants write their notes manually on their paper notebook and do not take any notes on-screen.

Readers' frequent use of the pointing strategy when reading on-screen was also observed by Park and Kim (2011), who noted that readers use the mouse to point to the text that they are reading on-screen. In the current study, readers used three objects to keep track of where they are in the

text, either the cursor, their thumb or an object such as a pen. One interpretation of the frequent utilisation of this support strategy in the current study which is also based on the present study findings (see 4.2.2) is that readers are attempting to apply enormous effort to keep them focused and engaged with on-screen texts, such as pointing, highlighting, and vocalising as they find it challenging to concentrate when reading on-screen.

GLOB strategies were the third category of strategies used during on-screen reading. Readers mostly read with a specific purpose in mind; identifying main ideas, attending selectively and skipping. The tendency of readers' to rely on these strategies results from the fact that during on-screen reading readers are more concerned with fluency and fast comprehension than with analytical reading. In accordance with these results, previous studies have also demonstrated that on-screen reading characteristically involves a more selective approach than linear reading (Nielsen & Pernice 2010; Liu & Huang 2008a; Liu 2005; Chou 2009). In contrast to the dominant use of problem-solving strategies, support strategies and global strategies, the rare use of critical reading strategies might be seen to relate to readers' lack of critical awareness and their unfamiliarity with on-screen reading. According to Johnson, Archibald and Tenenbaum (2010), most students lack effective critical thinking skills that are needed for success in colleges and universities. These two factors in turn may combine to challenge readers to apply higher-level strategies, such as connecting information and evaluating the content or style of a text when reading on-screen. Thus, it was reasonable for students in the study to adopt critical strategies less often during on-screen reading.

The analysis of the common sub-strategies that the readers were employing during their on-screen reading reveals that the readers were relying heavily on specific types of sub-strategies. They were marking the text, pointing, confirming, taking notes, vocalising words and sentences, having a purpose, skipping, previewing, locating main ideas and using electronic translation. On the other hand, there were sub-strategies that were employed much less frequently by the readers. For example, the readers were rarely reviewing, making summary, using electronic vocalisation, formulating questions, paraphrasing, using context, anticipating, connecting ideas and critically thinking. This indicates that the readers were reading on-screen without deep comprehension and content analysis. This is consistent with Carr's (2010) ideas and Liu's (2008) study results that prove the decreased level of in-depth analysis and concentration during on-screen reading.

The following discussion answers RQ1c, concerning the nature of on-screen L2 academic reading processes based on the data presented in 4.5, and introduces the two paradigmatic approaches: top-down and bottom-up.

### **6.2.2 The nature of the on-screen reading processes (RQ1c)**

In answer to RQ1c (What is the nature of on-screen reading processes in terms of bottom-up and top-down approaches?), the findings suggest that the nature of the on-screen reading processes implied that on-screen L2 academic reading comprehension is an interactive process, combining both top-down and bottom-up approaches. However, the rate of activation of the two processes; top-down and bottom up is unequal. In the case of on-screen reading, readers are more engaged with on-screen texts involving bottom-up processing than they are with the top-down approach.

This finding, as noted in 4.5, concurs with findings in previous research studies, which have shown that reading digitally includes both processes (Uso-Juan & Ruiz-Madrid 2009; Huang et al. 2009; Arnold 2009; Konishi 2003). One suggested interpretation of the results reported in both this and previous studies is that interactive reading processes must be employed to ensure comprehension of a text, even in the case of on-screen reading. This finding further supports the ideas proposed by several reading researchers (as presented in 2.6.1, 3) concerning the positive role that interactive processes play in L2 reading comprehension (Grabe & Stoller 2011; Hudson 2007; Hedgcock & Ferris 2009; Eskey & Grabe 1988; Tracey & Morrow 2012; Carrell et al. 2000; Kintsch 2005; Zhang 2007; Vosoughi et al. 2012).

When questioning the frequency of the on-screen reading process, the different ratio when utilising these two approaches (bottom-up and top-down) in the current study reinforces the present research findings (presented in 6.2.1) that the aims of on-screen reading are to search for and uncover information, rather than to evaluate, analyse and comprehend it in depth.

Student readers in the current study utilised the top-down approach to check the relevance of the text content for their academic purposes. Consequently, for these reasons, top-down processing was used much less frequently than bottom-up processing. When reading on-screen, participants do not employ strategies intended to comprehend, analyse and evaluate the text in any depth. They mainly read to assess the location and relevance of information. For example, they sometimes choose to skip irrelevant sections, and use strategies such as reading for purpose and previewing the text, whilst interacting heavily with the text via the bottom-up approach. That is to say, they annotate, translate and point at portions of the text during their on-screen reading.

Findings concerning the use of the top-down process during on-screen reading in the current study correspond with the results of other research studies which have found that readers consistently prefer higher level reading processes, such as having a purpose in mind before and/or during reading, assessing text relativeness and navigating while reading, to enrich their background knowledge (Zaki et al. 2009; Ramli et al. 2011). However, these studies did not investigate the use of higher level processing, such as critical reading and in depth comprehension on-screen. The current study found that limited application of higher level processing to achieve deep comprehension was critical when employing strategies such as activating background knowledge and connecting information.

When aiming to achieve reading comprehension, researchers argue that the application of top-down processes contributes to enhancing readers' reading comprehension and that a good reader utilises a high level top-down approach when reading, rather than a bottom-up one (Huang et al. 2009; Grabe & Stoller 2011; Sterzik & Fraser 2012). AlKhaleefah (2010) conducted a study of L2 readers, and found that good readers employ more top-down strategies than bottom-up ones. Lin and Yu, (2013) supported this, state that proficient L2 readers use more high level reading strategies than language oriented ones. Accordingly, the readers in the current study could be categorised as better readers when reading printed paper than when reading on-screen. The results could also demonstrate that readers do not fully engage with and comprehend the text on-screen, as they employ a low level top-down approach.

Other reading researchers have demonstrated that the level of proficiency in L2 affects strategy use; readers with low L2 proficiency level employ more bottom-up approaches when reading, while readers with a higher level of L2 proficiency employ more top-down approaches (Chun & Thompson 2008). Similarly, Huang et al. (2009) stated that language proficiency is a factor that influences reader type and guarantees the frequent use of reading strategies. However, the findings of the current study contradict those reported by previous researchers. When readers were observed reading one text on-screen and one printed text, they performed differently during both reading tasks, regarding top-down and bottom-up processes. This arguably disproves the findings of previous research studies that suggest that language proficiency is a microcontroller of readers' use of top-down or bottom-up strategies. This finding suggests that being digitally academic strategy literate is about having the competences and the capabilities to approach the text via both processes; top-down and bottom up.

The following section elaborates the answers to RQ1d and discusses the application of reading sub-strategies during readers' interaction with different levels of text, i.e. text as a single unit and in individual sections, paragraphs, sentences, phrases and words.

### **6.2.3 The nature of the hierarchical application of on-screen reading comprehension strategies (RQ1d)**

Regarding RQ1d of whether L2 readers use different sub-strategies to deal with different points of the text, and their nature, the findings demonstrate that the readers interact with the text on-screen through multiple stages, namely text, section, paragraph; and sentence, phrase and word levels. Readers go through each of these stages fairly linearly, and employ a number of sub-strategies to interact with texts on-screen.

First, they initiated the process of reading by searching for a specific text related to a specific discipline on-line. Readers then filtered and categorised the articles and saved them in different folders, following different methods of organisation, such as by topic or academic purpose. During this stage, readers focused their attention on the title of each text. This was followed by the assessment stage, in which readers previewed the text in order to gain a general idea about the article (see 4.3 for the data).

This leads on to the section level, which also involves reading the abstract. At this point the readers were still undecided about whether or not to proceed with reading the text or part of it. It may be that some readers decide at this point that they have enough knowledge about the topic that they are reading about, and do not need to know more. In this case, they ignore the introductory and literature sections, and proceed directly to the discussion sections. On the other hand, 25% of readers read the abstract and the introduction of each paper, in order to get a general idea about the paper and the topic. 40% of the readers aim to read only the first half of the introduction section in order to identify the writer's point of view. By contrast, other readers mentioned that they aim to read only the last part of the introduction, to get an overview of the article that they are reading. One of the readers mentioned that, after reading the abstract and assessing the relevance of the article to her academic purposes, she watches YouTube videos about specific experiments related to the article. She then decides whether or not to read the paper. By contrast, 75% of the readers mentioned that they read the entire article from beginning to end in a sequential order, starting with the abstract, followed by the introduction and the literature review, then the methods, results, discussion, and conclusion (see 4.3 for further data). This finding contradicts many reports in previous literature, which describe on-screen reading as a selective process (Huang 2009; Liu 2008; Moghaddam & Talawar 2008). However, at the section

level, it appears that 35% of the readers read in a linear manner to obtain a general understanding of the content section by section, as part of a sequential and linear process.

Moreover, 20% of the readers, once they finish reading one section, pause and think about the main idea of that section, in order to assess its relevance to their academic purposes. They then re-read the section and paraphrase its main idea in their written document. Interestingly, 15% of the readers stated that they summarise the article and write their own abstract of the text after reading most of its sections, in order to enhance their reading comprehension of the article, and for retention purposes. 30% of the readers scan all the sections in the text and highlight those sections which they aim to re-read.

At the paragraph level, specific strategies are involved. 40% of the readers explained that they interact with paragraphs first by looking for visual aids, such as tables or charts, to uncover the main idea in each paragraph, before reading the text. In addition, 25% of the readers explained that they would only read the first couple of sentences of each paragraph and the final two sentences of a text in order to get an overview, before re-reading the entire paragraph, whilst making notes. Then, they apply strategies of interacting at sentence, phrase and word level, which comprise a lower level of reading interaction.

Interestingly, 85% of the readers interact with on-screen texts at the previously mentioned four levels, and then resort to printing the article and re-reading it from the hard copies (see 4.3.4). Similar findings have been reported in many other studies conducted by digital literacy researchers. Liu (2008) found that 80% of the participants reported that they either always, or frequently, print e-texts for reading. Similarly, Chen (2010) and Poole (2008) found that students prefer to read printed documents over e-materials. This justifies the fact that readers in the current study had no previous instruction or practice of reading on-screen. In addition, readers are not fully aware of how to read on-screen for full comprehension. Thus, at the end of the on-screen reading process, they resort to printing the article if they need to attain complete and in depth comprehension. In accordance with these results, Young and Gedeon (2000) contended that the final stage of on-screen reading can be said to be printing out articles for in depth reading.

The findings suggest that readers had elements of digital academic strategy literacy (DASL) (presented in 2.3.1) and were able to interact with the on-screen text using their information and computer literacies.

The following section answers RQ1e, concerning the nature of employing the digital affordances during on-screen reading by postgraduate readers in order to enhance their academic reading comprehension.

#### **6.2.4 The nature of using e-text resources (RQ1e)**

In relation to RQ1e (What types of technological benefits (digital affordances) do L2 readers take advantage of when reading on-screen, and with what frequency?), the findings presented in 4.6 demonstrate that readers used various types of e-resources during the on-screen academic reading task: presentational, navigational, translational, explanatory, illustrative, notational, instructional, collaborative and computer functions (see Figure 14, p179 for the used digital affordances & 3.9.4 for e-resources explanation). However, these results were disappointing, as the use of most of these e-resources was low. This reveals that readers are not competent in terms of their media and computer literacy as they lack a broad understanding of what tools to use on-screen and how to use them effectively to achieve their academic purposes. They were not even aware of the existence of some of these e-resources, and their knowledge was limited to specific digital affordances (see Figure 13, p.177).

There are a number of potential explanations for the lack of use of the presentational e-resources while reading on-screen. Readers are unfamiliar with presentational e-resources and unaware of their benefits. Also, readers themselves made no effort to enhance their reading via the presentational e-resources and this could be due to a lack of engagement with the e-text. In addition, readers' use of notational e-resources reveals their lack of ability to annotate e-text. The readers were highlighting specific parts of the text but rarely taking notes on-screen. The data also reveals that none of the participants were observed (or reported) underlining, writing in the margin or drawing while reading on-screen. However, this could be due to the lack of provision of these types of resources in any of the PDF files used by the majority of readers when reading academic articles on-screen.

The high volume of use of navigational resources while reading on-screen as found in 4.6.2 matches reports in other recent studies; for example, Akyel and Erçetin (2009) and Lawless et al. (2007) who found that readers spend a large proportion of their on-screen reading time navigating links embedded in the text. During each of the four types of navigation, the readers navigated, searching for relevant or specific information that was required for academic purposes. In accordance with the present results, previous studies found that readers navigate using a menu driven navigational scheme. Others navigated websites, and text embedded links (Lawless et al.

2007). In addition, Protopsaltis and Bouki (2005) found that readers navigate when reading on-screen, as they apply different navigational strategies: linear, mixed and mixed review.

A possible interpretation of the different navigational processes noted in the current study is that readers have learned to use the menu bar to locate relevant sections in order to limit the time spent reading. Thus, they do not scan the entire text to find the necessary sections. This interpretation supports the hypothesis that on-screen reading is a selective, and not a linear process, as proposed by other reading researchers such as Liu (2008). An additional three navigational processes utilised by the participants in the current study suggest that the main purpose of navigating while reading on-screen is to enrich background knowledge. This interpretation of the result correlates with Lawless et al. (2007), and Salmerón and García's (2011) studies. The comprehension test scores that they obtained proved that navigation enriches readers' background knowledge and in turns facilitates their comprehension while reading (Ibid.). Akyel and Erçetin (2009) found that readers use navigational strategies to learn more about a topic from the texts they read. This implies that on-screen reading enables readers to enrich their background knowledge by accessing an increased number of related and simplified materials. This enhances their reading comprehension, and facilitates immediate comprehension by enabling them to instantly search and uncover explanatory information. This finding further supports Yang (2008), who stated that navigation during on-screen reading enhances readers' reading comprehension in many ways, such as opening up new dimensions to readers and enabling them to explore the content of texts in any order without being limited by the linear nature of traditional printed texts.

The data (see 4.2.3, 4.7.5 & 6.5.3) also establishes the role that constructivist theory (see 2.6.2) plays in reading, comprehending and learning written information. A strong relationship exists between reading comprehension and readers' background knowledge (see 2.6.3 for further details about schema theory). Several reading-focused researchers have emphasised the positive role played by readers' content schemata in enhancing readers' reading comprehension (Zhang 2010; Bin 2013; Hudson 2007; Zhao & Zhu 2012; Vosoughi et al. 2012). The current study provides further evidence of this (see 4.2.3 & 4.7.5 for data; & see 6.2.2 for discussion), in relation to second language reading comprehension. According to this, it can be argued that the navigational aspect of on-screen reading positively influences and enriches readers' schematic content knowledge, which consequently improves their reading comprehension. However, other reading researchers have asserted the negative role of the mental calisthenics encountered during the navigating process when reading on-screen. For example, Pearson, Buchanan and Thimbleby

(2013) have reported that reading on-screen increases readers' cognitive workload, observing that a huge amount of information hinders the reading process. In addition, Wästlund, Norlander and Archer (2008) have reported that the navigational process is an additional process overloading the readers' reading comprehension. Carr (2010) reported that as navigational and searchable aspects of screen reading increase, this leads to the fragmentation of on-screen reading as readers jump between documents without devoting sustained attention to any of them.

Readers' employment of translational e-resources during on-screen reading proves the effective role of the language schemata for enhancing readers' reading comprehension. Several reading researchers have noted the positive role that vocabulary knowledge plays in readers' reading comprehension (Guo & Roehring 2011; Mehrpour & Rahimi 2010; Pulido & Hambrick 2008; Schmitt et al. 2011). In the current study, readers were utilising the translational e-resources to find the meaning of the general and technical vocabulary that they came across while reading. This finding proves that reading on-screen enhances readers' vocabulary schemata by allowing for the use of approachable translational e-resources. Thus, readers can easily and instantly find the meaning of unknown general and/or technical words, think about their meaning in the specific context of the text and enhance their reading comprehension. In this regard, the use of translational e-resources has a role in enhancing readers' vocabulary schemata and consequently their reading comprehension. These findings corroborate Kern's (2008) assertion that translational strategies have multidimensional benefits for L2 reading comprehension, involving facilitating semantic and syntactic processing while reading. When considering the use of these three types of translational e-resources, the data in this study reveals that the majority of readers rely more on Google translate than on any other kind of the translational e-resource, when seeking to understand the meaning of an unknown text, sentence, phrase, or even a single word. One possible explanation for this is that readers require an instantaneous translation when reading; five Master's and two PhD readers reported that they do not wish to spend time looking up words in dictionaries or reading more carefully to deduce the meaning of the words from context. However, readers might not be familiar with the e-text translation facilities that are part of the computer system; thus they are unlikely to employ these services to understand meaning. Furthermore, the frequent use of Google translate indicates that readers are more willing to translate into their native language to understand unknown portions of a text rather than finding synonyms in L2.

The current study also revealed that readers use simplified websites to uncover relevant information to provide them with more explanation of specific sections in their reading texts. These include Wikipedia, blogs and/or website search engines, such as Google. In addition, videos

are the most common illustrative e-resource used when reading on-screen. Readers watch videos to enrich their knowledge of specific subjects, to increase their vocabulary relating to their field of study and to understand technical experiments (see 4.6.5 for data and examples). Overall, these results indicate that a number of the participants enhanced their on-screen reading comprehension by utilising these varied illustrative e-resources: they watch videos and power point presentations and listen to reading texts. These findings are consistent with Park and Kim's (2011) findings, in which readers acknowledged that they watch videos and look at pictures during on-screen reading as they feel that these enhance their reading and comprehension.

There are several possible explanations for why readers' use some e-resources and neglect others. Readers may use e-resources that are easy to use, such as presentational and translational resources, rarely taking notes or using collaborative e-resources, as they require greater effort and more competences and capabilities to use them for reading on-screen. A further explanation is that readers might believe that they may not need to use specific types of e-resources as collaboratively or extensively as they use presentational e-resources, as they believe that these types of e-resources might not contribute to their reading comprehension. Furthermore, readers may not be aware of the value and the extensive benefits of these e-resources for reading comprehension and learning. This could be due to their lack of awareness concerning the majority of digital affordances.

The reader is typically involved in several tasks alongside their reading comprehension, such as translation, writing, searching, reading, watching videos and reading again (see 4.6). This provides a significant insight into on-screen reading techniques, including tasks comprising other reading processes. For instance, readers read, search, save, copy, paste, modify, evaluate and re-read. Thus, on-screen reading enables readers to perform several tasks while reading. They can search, display more than one text, connect information, evaluate, take notes simultaneously and write. It is possible, therefore, to assume that by applying a multi-tasking process while reading, readers can achieve broader knowledge and interact more deeply with the content of the text to achieve successful comprehension. However, a number of studies have argued that the cognitive cost of the multi-tasking features of technology might negatively impact learning (Abate 2008; Bowman, Levine, Waite & Gendron 2010; Kirschner & Karpinski 2010; Lee, Lin & Robertson 2012; Ophir, Nass & Wagner 2009). Thus, several researchers have suggested that displaying more than one window on the screen could increase the cognitive load on readers, resulting in information overload and adversely affecting reading speed (Bowman et al. 2010; Mangen et al. 2013). These findings raise intriguing questions for further research (presented in 7.6) regarding the

relationship between the multi-tasking aspects of on-screen L2 academic reading and its ability to enhance readers' reading comprehension and learning. The data in the present study (see 4.6.2, 4.6.4, 4.6.5 & 4.6.9) suggests that mastering the competences and capabilities of digital academic strategy literacy (DASL) involves the multi-tasking aspects that enhance readers' on-screen reading comprehension.

It can thus be suggested that the use of these e-resources is a form of scaffolding for reading comprehension, which can improve readers' ability to comprehend challenging texts that are beyond their unaided comprehension abilities. These results support previous research into the role of technology in scaffolding digital reading comprehension (as presented in 2.6.5). The current study suggests that the use of these digital affordances while reading on-screen improves readers' linguistic knowledge, builds their content knowledge, and improves their overall digital strategies literacy. The use of some of these e-resources, such as translational, notational, and summarising sources decrease over time as readers do not need to use them as frequently to achieve comprehension as their knowledge improves. On the other hand, other e-resources, such as collaborative and navigational sources, will continue to be relevant as they are useful not only for comprehension purposes but also possibly for critical reading.

In relation to explaining and interpreting the nature of on-screen reading, the present study further answers RQ1f by discussing various on-screen L2 academic reading comprehension challenges.

### **6.3 On-screen reading challenges (RQ1f)**

In answer to RQ1f (What is the nature of the academic on-screen reading challenges faced by postgraduate L2 readers of English in the UK educational context when reading a research article in their field of study?), the findings reveal that readers experience various sorts of challenges during on-screen L2 academic reading, namely comprehensional, physical, language and behavioural challenges (see 4.7 for further details). These challenges are a result of lack of digital literacy competences and capabilities, lack of familiarity with on-screen academic reading strategies (behavioural issues), experiencing physical issues, having insufficient L2 language proficiency and interacting with unfamiliar text content. These are discussed in detail in the following sections.

#### **6.3.1 Fast but slow**

Interestingly, in this study, although readers reported that their on-screen reading is slow, actual observation of their authentic print and on-screen reading showed that readers spent longer

reading a printed text than an on-screen one and they invested more strategies and time during print-based reading than during their on-screen reading. This result of the present study differs from several studies that assert that on-screen readers spend longer comprehending a piece of text (Kerr & Symons 2006; Al-Othman 2003; Kim & Kim 2013; Kurniawan & Zaphiris 2001; Mayes et al. 2001; Martin & Platt 2010; Ramli et al. 2011). In reference to this, Dillon (1992) suggested a performance deficit of between 20% and 30% when reading on-screen. Ferrari and Short (2002) reported that screen-based reading is 30% slower than print-based reading. Similarly, Kim and Kim (2013) observed that readers read more slowly from LCD monitors than they do from printed paper. Solak (2014) found that it is possible to read a printed text 12% faster than an on-screen text. Chou (2012); and Martin and Platt (2010) found that readers believe they read more slowly on-screen than they do from paper. In this vein, Zaki et al. (2009) distinguished between effective and poor readers; they stated that good readers engage higher level reading processes, whereas poor readers slow down their reading, resorting to more simplified sources, taking notes and diverting their attention toward translating words and matching meaning to context.

This use of e-resources is consistent with the observations of readers in the current study, who spent time translating vocabulary within the text, diverted their attention to electronic translational websites to translate words and spent time matching meaning to context in order to enhancing their L2 reading comprehension. For example, we can observe the actions of AML.

*'I need Google translator [she opens a Google translator page/ returns to the reading article/highlights a specific word/clicks copy/returns to Google translator page/pastes the word/clicks translate/returns to the reading article]'* (Ph1/TA)

Some reading research studies, however, suggest there is no difference in reading speed between on-screen and print based reading (Dundar & Akcayir 2012; Grzeschik et al. 2011; Holzinger et al. 2011; Shibata & Omura 2011; Nimwegen et al. 1999). For example, Holzinger et al. (2011) conducted an experiment with 111 Medical professionals, each of whom were asked to read reports and internal Medical documents on both an LCD monitor and paper. He found no significant difference in reading speed between LCD and printed formats. Shibata and Omura, (2011) asserted that reading speed when reading from printed paper is equal to reading speed when reading from electronic media if page turning during electronic reading is excluded. In this regard, Nimwegen et al. (1999) revealed that it is moving the page down and scrolling when reading on-screen that increases reading time. They found that the content of the text has a greater influence on readers' reading rate, and also stated that external factors, such as light,

noise or physical issues may affect readers' on-screen reading speed, as can readers' physical or behavioural factors that are discussed in the following sections.

The readers in the current study reported that they are slower at on-screen reading than print-based reading as a result of these factors. L2 readers in the current study lack the confidence in their on-screen reading comprehension and therefore rely on re-reading the text several times to fully comprehend it. The readers are unfamiliar with on-screen reading and interacting with e-text, which in turn makes it challenging to read at the same speed as they can read print. Thus, they employ fewer strategies to increase their reading speed and consequently achieve less of an understanding of on-screen text.

Furthermore, the data presented in this study suggests that on-screen reading creates a barrier to the use of reading strategies. Readers in the current study were rarely able to apply the strategies that they use frequently when reading printed materials to screen-based materials, such as highlighting, taking notes, underlining and working to ensure retention. These findings are consistent with previous studies, which state that readers are restricted to basic reading strategies while reading on-screen (Chou 2012; Liu 2008). Annand (2008) found that readers complained about their inability to annotate texts on-screen. However, this lack of strategy use could relate to readers' lack of basic digital skills, such as writing notes and marking texts on-screen. Thus, reading on-screen challenges readers to employ strategies that facilitate their reading comprehension.

### **6.3.2 Interesting but distracting**

The findings of the current study also demonstrate that the majority of readers find it challenging to maintain concentration and to stay motivated when reading on-screen, and struggle to avoid losing interest. These challenges seem to have negative effects on readers' L2 academic reading as they reduce comprehension levels. Countering the above findings, Grzeschik et al. (2011) reported no concentration deficit attributable to the on-screen nature of a text.

Readers were also easily distracted when reading on-screen by the availability of an Internet connection and other digital activities such as scrolling. It was a challenge for readers to keep focused, as they were tempted to indulge in activities other than their assigned reading, such as searching the web for entertaining websites, checking email, watching YouTube videos, talking to other people via social media websites or even shopping. Consequently, they lose concentration and waste time. Similar to the present study, other researchers have found that computers present too many distractions to readers (Kelley & Warburton 2011; Pearson et al. 2013). Rose (2011) found that readers are more tempted to check email, chatrooms such as (MSN), Facebook

and Twitter during on-screen reading than during print-based reading. Readers were aware of these types of distractions even though they tried to ignore them. Similarly, Gous (2014) asserted that 'digital distraction' and the possibility of linking to other webpages are the main reasons why readers lose concentration and read in a superficial manner. Margolin et al. (2013) demonstrated that distraction during on-screen reading could impact readers' interaction with the text, which in turns negatively affects comprehension.

Moreover, disorientation in hypertext over time causes additional distraction and frustration, leading to a greater tendency to experience cognitive overload, which may negatively affect readers' comprehension level and disrupt concentration (Carr 2010; Hara & Sellen 1997). Tanner (2014) asserted that the availability of alternative clickable text is a source of distraction that affects readers' concentration and speed, which in turn can affect readers reading comprehension. Rose (2011) also mentioned that the act of scrolling and grappling with the mouse takes some attention away from the text itself, diverts readers from what they are doing and increases their cognitive load. These results are consistent with the findings of the current study in which readers found that the availability of hyperlinks and the accessibility to other webpages distracted them from pursuing their academic reading and thus they lost motivation to read on-screen.

Another distraction for readers' in the current study during on-screen reading is lack of familiarity with reading academic text on-screen, which makes it difficult to engage fully with the e-text, as readers are not intellectually proficient at avoiding distraction. Additionally, readers' backgrounds and previous relationship with on-screen reading for entertainment might affect concentration levels. Previous learning and reading practices, based on reading and learning from a paper format may have become habitual. Thus, this attitude is connected to the issue of lacking digital academic strategy literacy.

### **6.3.3 Practical but uncomfortable**

Physical factors also make it difficult for readers to engage with texts on-screen over a long period. Three physical factors (the inability to change reading positions and physically sensing and owning the paper, difficulty tracking written sentences using an object and vision problems) were seen as primary distractions for participants reading on-screen (see 4.7.3 for data and examples). In agreement with Marshall's (2010) argument, readers in the current study found that interacting with texts on-screen causes physical challenges with regard to the mobility and the tangibility of the text. These results support the argument of Carr (2010), who highlighted the fact that the act

of reading involved not only sight but also a tangible relationship with the text. Rose (2011) found that readers prefer to physically hold a paper in their hands and scribble notes, underline and highlight the text on it in order to fully comprehend it. She also found that readers experience tense shoulders, head and neck ache during on-screen reading (ibid). In addition, Annand (2008), Liu (2005), Jeong (2012) and Berg, Hoffmann and Dawson (2010) and Kang, Wang and Lin (2009) asserted that readers find it challenging to read on-screen as they are affected by visual problems, as on-screen reading requires a reduction in the frequency of eye blinks, which consequently causes dry eyes and fatigue. Pearson et al. (2013) asserted that printed text is considered to be more lightweight, cheaper and more familiar when compared to computers or other sorts of screens. Similarly, Martin and Platt (2010) found that carrying laptop computers is difficult for many readers. Chou (2012a) underlined the fact that the portability and the ease of carrying printed text in comparison with computers is one of the factors that discourage readers from e-texts and reading on-screen. Carr (2010) stated that reliance on on-screen texts demands continuous access to computers and ensuring that batteries remain charged. All these results support the findings of the current study (see 4.7.3 for data) that reveal the physical factors that discourage readers from reading academic text on-screen.

#### **6.3.4 Yet L2 proficiency**

Another category of on-screen reading challenge concerns reading in L2 (English in this context). One of the readers reported that her L2 reading difficulties were due to her high level of proficiency in L1 and her low level of proficiency in L2. That is her subject intelligence is constructed in L1 and when it comes to reading L2 texts, the L2 is a significant barrier to comprehension. Thus, she tends to heavily translate texts, read and think in her L1. Other participants reported similar problems, rooted in low L2 proficiency. This finding concurs with previous studies that state that students' L2 proficiency is one of the factors that affect readers' on-screen reading motivation, comprehension and learning (Chou 2012). The majority of participants in the present study reported that reading in L2 and understanding new vocabulary while engaging in academic reading is one of the main challenges that they face. Vocabulary challenges during L2 academic reading tasks relate to both general and technical vocabulary. These results corroborate Abdul-Hamid and Samuels (2012), who found that EFL readers experience challenges when comprehending general academic vocabulary while reading English texts. In addition, Shen (2013) observed that both English language and engineering student majors find comprehending general and technical vocabulary while reading the most challenging aspect. Similarly, Hsu and Ou Yang (2013) found that ESL students encounter vocabulary challenges when reading English Science and Technology textbooks. Lee and Spratley (2010) and

Snow (2010) asserted that reading texts that include vocabulary related to a new subject area or scientific field adds to challenges with reading comprehension, even for first language readers. These findings are consistent with the results in the present study, which revealed that reading unfamiliar information challenges readers' comprehension skills (see 4.7.5 for data and examples). This result corresponds with previous research findings that emphasise the difficulties associated with comprehending unfamiliar subject knowledge during academic reading (Shen 2013).

The findings of this study also indicate that the style of the text can cause problems while reading. For example, reading long paragraphs and texts with no subtitles poses a challenge for second language readers (see 4.7.4). In addition, placing citations between sentences contributes further to the challenge which readers experience when reading an English text. Academic style can include long, passive and complex sentences, which are difficult for L2 readers to understand (Ehrich 2006; Shen 2013; Tong et al. 2011).

Taken together, readers variously experience slower reading, physical issues, loss of concentration, feelings of boredom and becoming distracted. Accordingly, readers' reading comprehension and learning achievements decrease. In 1984 Alderson categorised the problems of foreign/second language reading as either a reading problem or a language problem. Alderson asked: 'reading in a foreign language: a reading problem or a language problem?'. However, several reading researchers have asserted that second/foreign language reading depends on both readers' reading abilities and second language proficiency (Carrell 1991). A lack of ability in either of these two areas causes a reading comprehension problem.

From the previous discussion, it can therefore be asserted that it is not solely language problems that inhibit L2 readers' on-screen academic reading comprehension. Moreover, it is not solely a reading problem either, as readers find it challenging to employ reading strategies to comprehend the text. In fact, on-screen reading introduces a third element: digital academic strategy literacy (DASL) (proposed in 2.3.1). For example, cognitive overload and dealing with it could be a significant problem (Kauffman et al. 2011). Hypertext links, the availability of the Internet, unfamiliarity with this type of reading, eyestrain and a sense of not achieving during on-screen reading could all contribute to on-screen readers' cognitive overload and challenges (Sandberg 2014). Therefore, it is necessary to rephrase the question and ask: is on-screen reading a language problem, a reading problem, or a digital academic literacy problem?

### **6.3.5 Approaches to overcoming on-screen reading challenges**

It should come as no surprise that the readers follow a number of different strategies to enhance their on-screen reading performance and comprehension. Table 9 and Table 10 present some comments made by various readers in the present study, which illustrate the strategies that they used to overcome some of the reading challenges that they encountered during the actual reading task.

(Continued overleaf)

L2 Language knowledge			
	On-screen L2 academic reading Challenges	Solutions	Examples
vocabulary Unfamiliar	SAR: 'I do not understand some of the technical words' (Intvw)	1. Finding a synonym	SAR: 'I look it up using the right click to get the synonyms'
	BDR: 'Here I read this idea but I could not understand it, as it includes new words' (SR)	2. Re-reading	BDR: 'I re-read it again'
	AML: 'it included difficult words that needs translation' (Ph1/SR)	3. Printing	AML: 'I prefer to print the difficult sections and read them from printed paper'
	ALA: 'I cannot understand the technical words and I need to translate them in order to understand the sentence' (Intvw)	4. Translating	ALA: 'I need to translate them to understand they are talking about what'
L2 Language knowledge			
	On-screen L2 academic reading Challenges	Solutions	Examples
sentences Complex	FAT: 'I don't know, it was not clear (.) I could not understand the idea (.) I feel the idea is complicated and each sentence depends on the other'(SR)	1. Re-reading	FAT: 'I re-read the sentences several times'
	AFA: 'Okay, here the sentences were very difficult (.) they are complex'(SR)	2. Ignoring	AFA: 'Here I ignored these sentences (.) they are really difficult to be understood'
	EMA: 'The meaning of these sentences is not clear (.) They are complicated (.) I think they were comparing these results with other studies' (SR)	3. Writing notes L1	EMA: 'I needed to think about it and write them in Arabic in my notes'

Table 9: 1 - Proposed on-screen reading challenges - Solutions - Examples

L2 Language knowledge			
Passive sentences	On-screen L2 academic reading Challenges	Solutions	Examples
	SAJ: 'Sometimes the structure of the sentence is difficult. Ahh, for example they use 'has been' and 'have been' ... Actually, I don't know if they mean in events in the past or now' (Ph1/Intvw)	1. Translating the entire sentence	SAJ: 'I use Google translation (.) Ahh, I put the whole sentence into Google translation'
	RSH: 'The information here, ahh, I needed to re-read this more than once because it is written in a difficult way (.) Ahh here it's in the passive' (SR)	2. Re-reading	RSH: 'I needed to re-read it to understand the exact meaning of the sentence'
Unfamiliar topic			
Discipline knowledge	On-screen L2 academic reading Challenges	Solutions	Examples
	MAH: 'My background is not in education and my English is not very good so I find difficulties to understand when I read' (Intvw)	1. Asking an expert	MAH: 'I meet an English tutor (.) Ahh, her background was in education (.) She helps me in general in the field of education'
	SAJ: Here it says relative risk in 95% ahh (.) i could not understand what is relative risk' (Ph1/SR)	2. Finding another source of information	SAJ: 'I needed to understand this so I searched in Google to understand what the relative risk is and what these percentages are'
	REE: 'You know when I read about these studies and the quantitative and qualitative (.) I cannot understand from the first time' (Ph1/Intvw)	3. Re-reading	REE: 'I need to read it many times to understand the ideas'
	AML: 'If I faced difficult sections while I am reading onscreen and i don't need them I don't even try to understand them at all' (Ph1/SR)	4. Ignoring	AML: 'I ignore them (.) if they are not relevant to my key points I don't confuse myself'
	AFR: 'Here I did not understand what dynamic posturography is' (SR)	5. Using context	AFR: 'I looked up the previous sentence and thought about it'

Table 10: 2 - Proposed on-screen reading challenges - Solutions - Examples

These include enriching their background and vocabulary knowledge related to their discipline by reading full theses, introductory books and simplified sources of information about specific topics, along with engaging in concentrated translation. They also speak about allocating specific times to reading and finishing specific papers, to avoid spending a long time reading. In this way, they direct themselves towards reading only the relevant parts and skipping unnecessary details. Interestingly, one of the strategies that the readers were employing to understand difficult texts while reading on-screen was printing out the paper and reading a hard copy format. When aiming to comprehend technical vocabulary while reading, 20% of the readers reported that they ask experts to clarify any technical terms. 90% of the readers employed re-reading strategies to understand technical terms from context and 85% resort to a translating strategy; interpreting the meaning of new terms using their first language.

When approaching a new discipline, some readers search for and read other simplified sources of information to enrich their background knowledge and thereby comprehend that new knowledge (see 4.6.2, 4.6.4 & 4.6.5 for data). This result supports the work of those reading researchers who argue strongly in favour of the role of content schema in enhancing readers' reading comprehension (Alptekin & Erçetin 2011; An 2013; Gilakjani & Ahmadi 2011; Al-Issa 2011; Zhao & Zhu 2012). Radzi and Abd Aziz (2014) conducted a study with L2 diploma level students to determine the effect of readers' background knowledge on their comprehension level. The researchers found that content schemata positively contributed to readers' comprehension of the text. Zhao and Zhu (2012) asserted that schemata have a positive impact on readers' attention and absorption of knowledge, increase their reading speed and organise their existing knowledge. The readers in the current study were able to search and read additional sources of information as they found it useful for enhancing their reading comprehension. However, readers may not be aware of the benefits of reading other source materials and enhancing their schemata would assist them in enriching their background knowledge and comprehending the information from a simplified text.

Other readers reported relying on the strategy of frequent re-reading. Similarly, 20% of the readers tried to comprehend statistical information with multiple re-reading (see 4.2.1 & 4.2.2 for data). Thomas and Healy (2012) found that readers' benefited from re-reading strategies in an experimental study, which was conducted to examine the effect of re-reading on L2 learners' reading comprehension. Hyönä and Nurminen (2006) demonstrated the functionality and value of looking-back and re-reading to augment reading comprehension and information retention in a study conducted to investigate adult readers' individual differences in reading styles. The findings

of the current and previous studies confirm the association between looking back and using re-reading strategies for better reading comprehension. Ozek and Civelek (2006) found that the re-reading strategy is the second most commonly used strategy by 4<sup>th</sup> year English language teaching students. In other cases readers ignored the graphs and tables and relied on the written sections of a text to gain understanding. Others took the opposite approach. Readers used a number of strategies to prevent loss of interest or concentration. Some relied on vocalising while reading, whilst others pointed towards the sentences that they were reading. Interestingly some readers employed both strategies simultaneously.

It was found that readers also employed several types of strategy in order to overcome on-screen reading challenges, such as re-reading, pausing, translating and navigating (see Table 9 & Table 10 for further information). The tables consist of two sorts of on-screen academic reading challenges, namely L2 language knowledge and unfamiliar topic. They are divided into four columns. The first column presents four kinds of the reading comprehension challenges followed by a column shows examples extracted from the readers' replies. The third column presents the solutions that the readers used to overcome such reading challenges, exemplified by quotes extracted from the readers' replies.

However, some of the readers noted other on-screen reading challenges, such as being distracted, lacking digital skills, and physical issues that readers either did not refer to, or did not employ any strategies to overcome. Failure to meet these challenges can inhibit the process of academic on-screen reading, and result in demotivation. Interestingly, many readers reported that they would often print on-screen text for comprehension and to retain the information.

In this section, the data explained in 4.7 concerning the challenges facing L2 academic readers when reading text displayed on-screen are discussed. Most readers were not aware of backup tools that could be used to assist with several reading comprehension problems, such as speeding up their reading, annotating or having a sense of using paper while reading on-screen. As the competences and capabilities to solve on-screen reading comprehension problems are part of digital academic strategy literacy (DASL), these results may indicate that most of the readers under investigation are digitally illiterate in these specific aspects of DASL. The findings demonstrate the various challenges affecting L2 readers' experiences when reading academic text on-screen.

## **6.4 Differences and similarities between print-based and on-screen reading (RQ2)**

The following section answers RQ2 and discusses the differences and similarities between on-screen and print-based reading (presented in 5.4), attempting to demonstrate the differences and similarities between the reading strategy categories, sub-strategies, processes employed, comprehension outcomes of print and on-screen reading; and reading challenges. Interesting differences and similarities were found in text interaction between using two types of reading formats, print and on-screen that will be presented in the following sections.

### **6.4.1 Reading processes and strategies (RQ2a)**

In answer to RQ2a (What are the similarities/dissimilarities in strategy type and use (frequency) when reading on-screen and print-based academic text?), the findings from three sorts of data; think-aloud protocols, stimulated recalls and field notes (presented in 4.2, 5.2 & 5.4) reveal that the readers interacted with the print-based text via both processes equally, namely top-down and bottom-up. The readers employed four sorts of functional strategies (PROB, SUP, GLOB and CRT) to comprehend print-based text. Comparison of the frequency with which various reading strategies are employed during on-screen and paper reading reveals that all four types of strategies are used more frequently when reading on paper than when reading on-screen (see 5.4 for a comparison). Contrary to all expectations, comparisons between paper and on-screen reading sub-strategies reveal that readers use more sub-strategies when reading on paper (see 5.4.3 for differences and similarities in sub-strategies). In other words, during on-screen reading, readers use fewer sub-strategies. Therefore, only when reading on paper did readers engage in those essential components of the reading process known to involve full comprehension; analysis and evaluation. This is because the readers used strategies, such as evaluating information, identifying main ideas and connecting ideas more frequently during their paper based reading than during their on-screen reading.

This confirms the unanticipated findings that readers interact with the text more effectively during paper based reading and so are more likely to achieve their academic goals using this medium. However, it is also worth noting that an additional range of e-resources is available to, and used by, readers when reading texts on-screen (see 4.6). The findings reveal that reading digitally differs from reading printed text. Digital reading engages readers in several processes simultaneously, including searching, watching videos, reading for writing, re-reading, searching

again and checking emails. On the other hand, print readers have increased concentration on the reading process, which includes reading, underlining, highlighting, re-reading, relating ideas and thinking critically.

The over reliance on bottom-up process while reading on-screen, could be related to the language proficiency of the participants. According to Chun and Thompson (2008), readers with lower language proficiency levels employ more bottom-up processes for comprehension than readers with a higher level of language proficiency. However, in the current study, those readers who read the printed text also engaged in reading on-screen. Thus, their over reliance on bottom-up processes while reading on-screen could be due to the lack of familiarity with the on-screen reading processes. This might affect their language level proficiency and temporarily decrease their L2 language knowledge, as they cognitively engage with other processes, such as interacting with the digital functions of the text. In addition, readers might be unaccustomed to engaging deeply and critically with a text on-screen, which results in lower application of the top-down reading processes.

This indicates that readers in the current study successfully engaged with both reading formats. According to Alderson et al. (2014), Hersch and Andrews (2012), Kintsch (2005) and Grabe (2008), effective reading consists of and requires the interaction between two reading processes. That is to say, participants comprehended the text better using a top-down approach when reading on paper in order to evaluate, analyse and utilise content. Meanwhile, they comprehended the text via the bottom-up processes, as they aimed to engage more fully with the text. However, during print-based reading, readers are better at achieving more successful outcome than they are when reading on-screen as they are more engaged with the paper text format than the on-screen one. That is, the top-down and bottom-up approaches were more evenly applied during paper reading than during on-screen reading.

In both formats, readers were utilising a wide range of the same types of strategy; i.e. PROB, SUP, GLOB and CRT reading strategies (presented in 5.4.2). These results match those observed in earlier studies. For example, Bolanos (2012) found that readers in both kinds of environments employed similar strategies; meaning negotiating, meaning enhancing, meaning reinforcing, meaning generating, and information checking. Similarly, Park and Kim (2011) found that college level ESL learners employed print-based reading strategies while reading texts on-screen. Konishi (2003) found that strategies such as global strategies, which were employed during digital reading were similar to those strategies used when reading from paper.

The frequency of use of these types of strategy differs between the two formats (see 4.2 for on-screen reading data & 5.2 for print-based reading data). The data reveals that all four types of

strategies (support, problem-solving, global and critical) are used less frequently when reading on-screen than when reading on printed paper (see 5.4 for a comparison). However, the findings of the current study do not support the previous research. Zaki et al. (2009) found that during on-screen reading readers employ more problem-solving and global strategies than during print-based reading. A possible explanation for this might be that readers in the current study were more engaged with the paper text than the on-screen one, as they employed more reading strategies during their paper reading in order to enable them to comprehend the text. This might also indicate that the readers were more likely to comprehend the paper text than they were the on-screen one. An additional consideration is that Majid et al. (2010) found that proficient adult readers employ more reading strategies than less proficient readers. Similarly, Demiröz (2010) stated that successful readers employ more reading strategies than poor or less successful readers.

Accordingly, from the current study, it is possible to hypothesise that readers read more proficiently from printed paper than they do from on-screen text, as they employed more strategies while reading on-printed paper. An in depth analysis of, and comparison between, the sub-strategies and the main strategies that the readers employed during their on-screen reading also clearly reveals the differences between the types of sub-strategies used by readers during paper and on-screen reading.

In the current study the researcher was not aiming to evaluate and compare any product of on-screen and print-based reading. However, when evaluating readers' overall interaction with reading print-based and on-screen texts (as found in 5.4), and readers' perceptions of on-screen reading (as found in 6.5.5), it was apparent that readers are more engaged with print-based texts, employ strategies more frequently and comprehend better when reading these texts. This result could be considered to be supported by the results' of earlier studies that specifically compare learning outcomes when reading on-screen and print-based texts. Lam, Lam, Lam and Mcnaught (2009) investigated 12 students' use of academic eBooks and concluded that electronic reading is not useful or practical for academic comprehension and learning. Murat and Ferdi (2014) found that reading on-screen is less efficient than reading from printed paper. Carr (2010) and Liu (2005) demonstrated low comprehension levels for reading on-screen texts compared to reading print-based texts. Solak (2014) found that readers' comprehension text answers based on print based reading were better by 15% than readers comprehension text answers based on screen reading. Kim and Kim (2013), and Mangen et al. (2013) also revealed that students who read texts in print scored significantly better on the reading comprehension test than students who read the texts

digitally. Stoop, Kreutzer, and Kircz (2013) found that reading printed text is more effective than reading on-screen text in terms of elaborating and digesting content.

In a similar vein, other researchers have reported that reading comprehension and learning rates are higher when reading traditional text books compared to e-books (Dillion 1992; Mayer et al. 2001). Jeong (2012) examined the effect of reading a traditional book and an e-book on readers' reading comprehension and found that readers' had better quiz scores after reading printed books than e-books. In addition, readers' perceptions of on-screen reading in the current study reveals better comprehension and learning outcomes when using printed paper reading texts. In other words, they think that they achieve better outcomes when reading from a printed text. Ji, Michaels and Waterman (2014) reported that the majority of readers said that they usually read more and learn more, when printed reading is supplied. Kang et al. (2009) reported a higher level of reading performance when reading printed book than when reading electronic ones in a study conducted on junior college students. All these results support the unexpected conclusion of the present study that readers are better engaged with print-based text and consequently achieve better comprehension.

#### **6.4.2 Reading challenges (RQ2b)**

In relation to RQ2b (What are the similarities/dissimilarities of reading comprehension challenges between on-screen and print-based academic reading?), the findings demonstrate that print-based reading challenges overlapped with on-screen reading challenges (see 4.7 for on-screen reading challenges & 5.3 for print-based reading challenges). Readers during both reading formats experienced challenges related to language proficiency, unfamiliar text content and employing reading comprehension strategies. However, on-screen reading comprehension involves further challenges that are limited to interaction with text on-screen, such as employing digital affordances (presentational, navigational, translational, explanatory, illustrative, notational, instructional, collaborative and computer functions) to comprehend the digital text. Some of the distractions associated with reading print-based texts, such as noise and being in an uncomfortable reading environment were expected to overlap with on-screen reading, while Internet related distractions are unique to the online backdrop to on-screen texts. Physical challenges such as eye strain and lack of concentration applied more to on-screen texts.

The obstacles that faced readers during both types of reading task related to L2 language proficiency. Readers of both formats experienced particular challenges with comprehending the vocabulary of both general and technical L2 language. An additional L2 related obstacle encountered by readers was the long, complex and passive English sentences. These sentences

were perceived as difficult to process and comprehend. In addition, the style of the written texts and the unfamiliar content affected readers' reading comprehension. With regard to language proficiency, the findings of the present study support previous research, linking vocabulary knowledge with L2 reading comprehension. Tannenbaum, Torgesen and Wagner (2006) investigated the relationship between word knowledge and reading comprehension, and found that both the breadth and depth of vocabulary knowledge influenced readers' reading comprehension. As far as the overall language factor is concerned, 75% of the readers in the present study were overcoming difficulties with comprehending complex sentences via re-reading, adjusting their reading speed rate, and/or writing notes in their first language. 35% of the readers also comprehended passive sentences by either re-reading the sentence or translating it to their L1. 40% of the readers also comprehended long extended paragraphs by re-reading them multiple times in order to understand their content.

For many of the readers, the employment of specific reading strategies for specific purposes was a challenge regardless of format. Strategies to enhance reading speed were mentioned specifically. The ability to retain information from a text was also a challenge for readers during print-based and on-screen reading. In addition, for most readers, the utilisation of specific strategies, such as evaluating content and thinking critically about information were major challenges that readers faced with both formats. However, during on-screen reading, readers faced additional strategic challenges, including an inability to annotate, highlight, underline and take notes (see 4.6.7 for further details about notational e-resources).

Readers seemed to generally be unaware of the strategies that they could employ to enhance their reading speed and retain information. This lack of awareness concerning thinking and connecting ideas and anticipating information was exacerbated by the on-screen environment. Loss of concentration and distraction, although taking a different form online, applied to both reading formats.

### **6.4.3 Reading components (RQ2c)**

In relation to RQ2c (What are the similarities/dissimilarities of reading components between on-screen and print-based academic reading?), the findings demonstrate that both reading formats appear to include elements of the same patterns. On-screen reading and print-based reading components are comprised of print-based reading comprehension competences and capabilities, content knowledge, and L2 language proficiency. However, on-screen reading comprehension involves a variety of different elements, namely, on-screen reading competences and on-screen

reading capabilities. Additionally, on-screen reading comprehension includes digital literacy as an essential element. On the other hand, print based reading comprehension involves only print-based competences and capabilities, content knowledge and L2 language proficiency.

These results are illustrated graphically in Figure 27, which presents a proposed model of on-screen reading comprehension components. It consists of two levels, namely on-screen reading comprehension components and print-based reading comprehension components. On-screen reading comprehension components consist of on-screen reading competences, digital literacy, on-screen reading capabilities and print-based reading comprehension components which include content knowledge, print-based reading competences and capabilities; and L2 language proficiency. These constitute important components of digital academic strategy literacy (DASL).

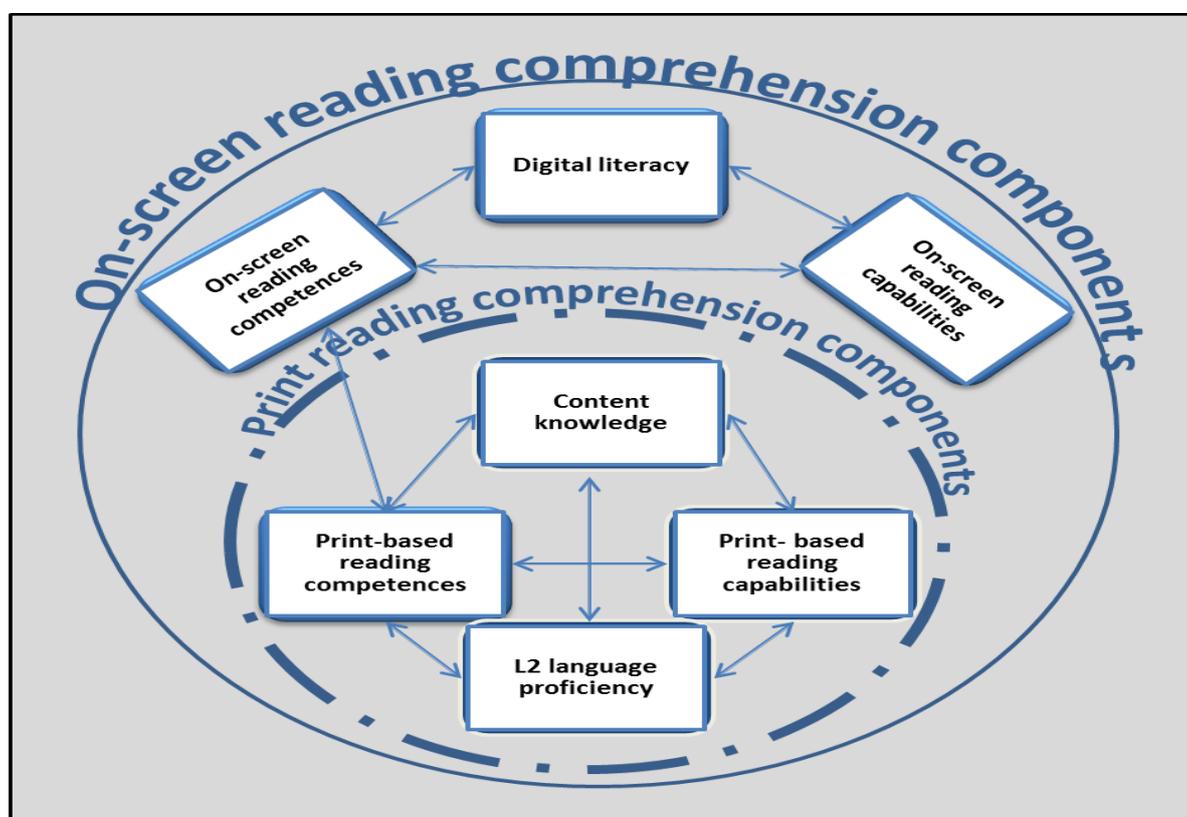


Figure 27: The proposed model of on-screen L2 academic reading comprehension components (based on the research data)

The data (presented in 4.2, 4.5, 4.6 & 4.7) revealed that on-screen L2 academic reading comprehension comprises multiple components. Reading comprehension capabilities consist of higher level reading processes, such as connecting with previous knowledge to comprehend and implementing purposeful reading. In addition, lower level reading processes can also contribute to reading abilities. For example, strategies such as translating specific words while reading, listening to pronunciation and reading sentences aloud were regularly employed when reading on-screen. This is consistent with findings reported by other reading researchers, who found that

on-screen reading demands use of both higher level and lower level reading strategies (Anderson 2003; Chou 2012; Zaki et al. 2009). Both reading formats require readers to employ higher level strategies and lower level strategies to understand the text. Alderson et al. (2014) highlighted the essential role of higher level and lower level reading processes in L2 reading comprehension. Similarly, Grabe and Stoller (2011) stated that lower level reading processes, that include word recognition, syntactic parsing, semantic proposition and formation, are fundamental requirements for reading comprehension. They also highlighted the important role of the higher level processes, such as background knowledge use and inference during print-based reading to take the basic information out of the text to build comprehension.

Interestingly, digital academic strategy literacy (DASL) appears to be an essential component for successful on-screen reading, such as digital interactional strategies; where readers scroll down pages, copy and paste, track sentences with the cursor, and navigate the text using the side bar. L2 language proficiency, including vocabulary knowledge and sentence/words pronunciation correlate with lower level reading processes. Similarly, content knowledge during on-screen reading operates interactively with higher level reading processes. In addition, digital reading knowledge presented as competences/on-screen reading strategy awareness constitutes a major component of on-screen reading.

With regard to content knowledge, both reading formats appear to include readers' knowledge about the content of a text as one of the main elements that enable and enhance reading comprehension. Alyousef (2006) and Hudson (2007) stressed the important role of readers' background knowledge in L2 reading comprehension. Equally, an important element for comprehending both reading formats is readers' L2 knowledge. Alderson et al. (2014) reported that knowledge of L2 grammar and vocabulary are components of L2 print-based reading proficiency. Alyousef (2006) stated that L2 linguistic knowledge, including vocabulary, structural and formal discourse knowledge, is a component of L2 reading comprehension. Hudson (2007) highlighted the role of breadth and depth of vocabulary knowledge in L2 reading.

Furthermore, competences (schema) of strategies, L2, content are an essential component of both reading formats. According to Allen and Hancock (2008); Iwai (2011); Maasum and Maarof (2012); Magogwe (2013); Yang (2011); Lian Zhang and Seepho (2013); Zhang and Wu (2009) and Hudson (2007) knowledge about reading strategies has a significant impact on readers' reading comprehension while reading a print-based text. Alyousef (2006) reported that knowledge and skills monitoring are components of L2 reading. Similarly, Mesgar, Bakar and Amir (2012) asserted that awareness of reading strategies is a necessity for on-screen reading. However, on-screen

reading requires an additional sort of competence which is not part of the print-based reading, called digital schema. Meanwhile, the differences between the components informing print-based reading comprehension and on-screen reading comprehension are also affected by reading competences and capabilities.

It is important to point out that by identifying and presenting the components of on-screen L2 academic reading, the requirements that enable readers to read and comprehend academic texts on-screen have been clarified. It is suggested that these main components should be treated as a single combined construct with reference to L2 on-screen academic reading. The researcher in the present study suggests that these findings could be generalizable across L2 readers in different contexts and at different educational levels. In addition, when the researcher identified the components of on-screen reading to understand them, she effectively established a means to define on-screen L2 academic reading challenges, that are discussed in 6.3.

In order to examine the possible effects of reading in different disciplinary areas, three case studies are presented in 6.5.1. The possible effects of individual differences are presented through two different case studies in 6.5.2. The effects of previous academic reading practices are presented in 6.5.3; and length of study are presented by comparing Master's students in the Ph1 and Ph2 and by comparing Ph1 Master's students with PhD students in 6.5.4.

## **6.5 Contextual perspective: Discussing academic readers and on-screen L2 reading in the 21<sup>st</sup> century**

The purpose of these case studies is to illustrate the differences and similarities of on-screen reading strategies and the use of e-resources by readers studying different majors and to determine whether disciplinary factors, individual differences, length of time of study and readers' previous educational system have an effect on readers' on-screen reading comprehension. These case studies are only a sample taken from a larger group and they do not represent the other readers. Hence, the purpose of these case studies is to shed a light on the relationship between these factors and on-screen academic reading.

### **6.5.1 Reading and possible effect of disciplinary differences - three case studies**

The reading practices of three PhD students have been scrutinised; DAL who is studying Computer Science, GAD who is studying Psychology and HEN who is studying Nano Technology. With regard to reading strategies, there are no significant differences between the three readers' use of the four main reading strategy categories; GLOB, PROB, SUP and CRT. For further clarification, these

results are illustrated graphically in Figure 28, which presents the similarities and the differences between the three readers' application of each of these strategy categories.

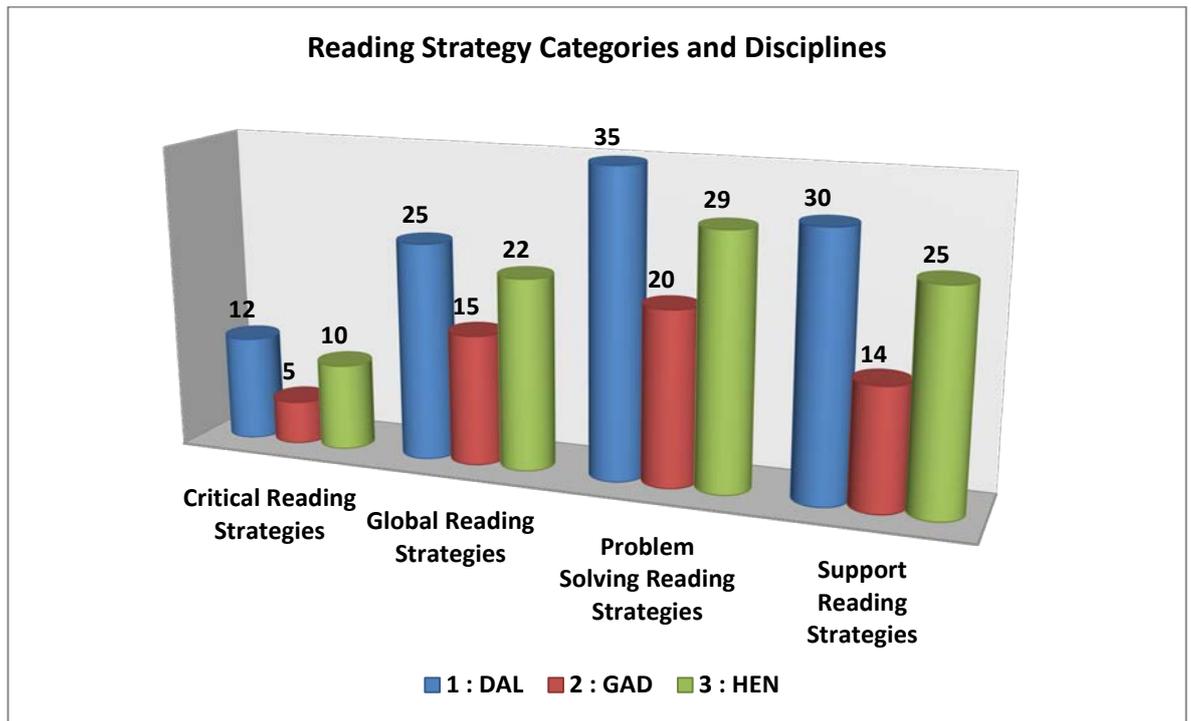


Figure 28: Reading strategy categories and discipline

However, the results show that DAL employs slightly more reading strategies than HEN or GAD. This could be a consequence of her motivation to read more on-screen and to improve her on-screen reading comprehension. On the other hand, GAD uses the least applied reading strategies; this could be explained by the fact that GAD rarely practices on-screen reading.

In terms of the use of e-resources, it can be seen that DAL is the reader who most often makes use of e-resources during on-screen reading; this could be related to her subject of study, computer sciences, or is perhaps due to her motivation to improve her on-screen reading. On the other hand, there is no significant difference between HEN and GAD in terms of their use of e-resources. For further clarification, these results are illustrated graphically in Figure 29, which illustrates the differences and similarities between the three readers.

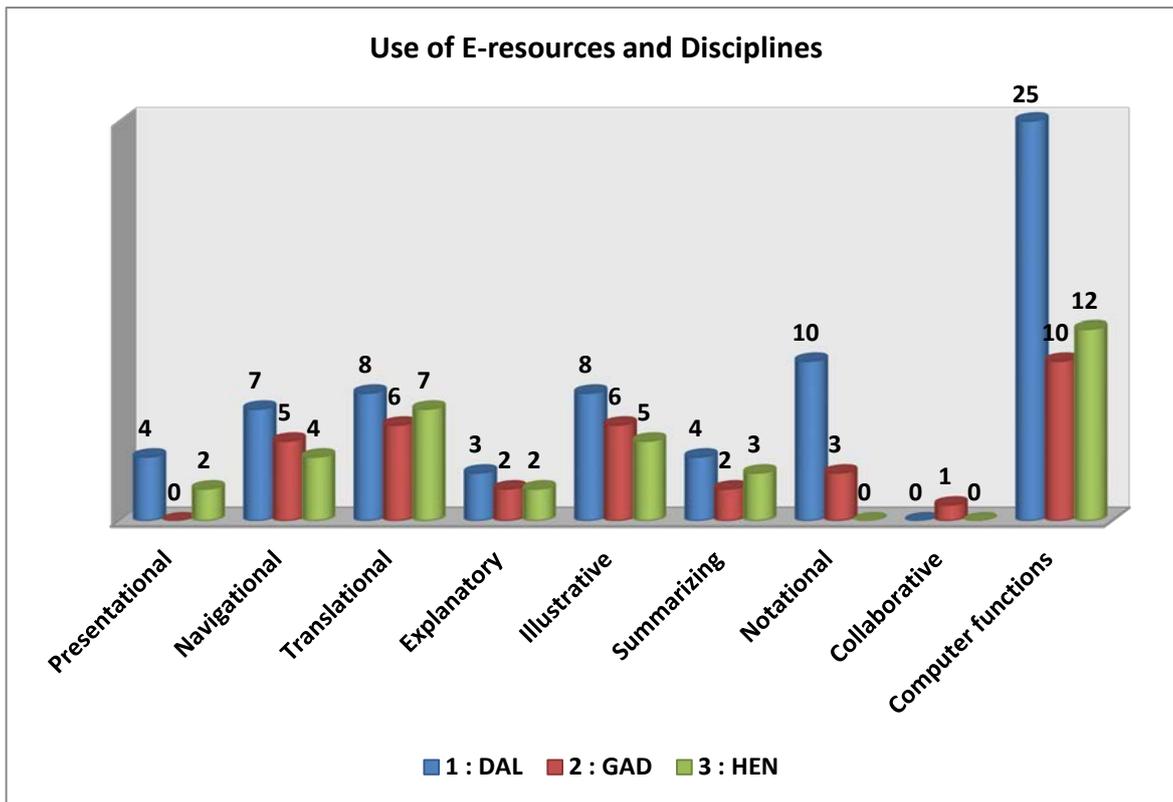


Figure 29: Use of e-resources in relation to discipline

Interestingly, GAD is the only one of the three who mentioned that she sometimes reads blogs as part of her academic reading, in order to increase her knowledge of psychological issues. This is exemplified in her statement that,

*'I read blogs related to people who are sharing their psychological problems, and I sometimes participate'* (Intvw)

With regard to preferred reading formats, it could be suggested that discipline might not influence readers' preference, although it does affect their reading practices. All three readers reported that they prefer to read research articles printed as hard copies, as opposed to reading on-screen. However, in the current study, DAL mentioned that although she prefers to read printed papers, she is currently training herself to read text on-screen in order to make use of e-resources for reading. Similarly, HEN stated that, out of necessity, she reads papers in both formats,

*'Actually I use both reading sources, the printed paper and its online version (.) I use the printed paper to paraphrase the highlighted sentences and use my notes and the online version for citation and writing my bibliography'* (Intvw)

HEN mentioned that most of the research articles in her chosen subject have a supplementary information article that provides details about the main article, and that she reads the supplementary information where necessary on-screen and writes comments on the original printed research article.

*'If I liked the paper very much I read its details from the supplementary information (.) in the article there is (esi) means return to the supplementary information (.) so I go back and read it, so the point where I stop I see where they mention it and read about it'*

*'Do you print the supplementary information?'*

*'No (.) usually I read it online'*

*The researcher: 'Why?'*

*'Because it will be so much printed material for one topic (.) I prefer to read the supplementary information on screen and write my notes on the printed paper'*

HEN also reported that during her reading, most of the time she needs to watch a video to illustrate the experiment that she is reading about.

*'So what happens with me, usually I read the abstract and look at the designs and the graphs and read the caution that is written under each one, and if it is interesting I watch the video, and if that is interesting I download it and print the article (.) I write comments about the video on the printed paper'* (Intvw)

On the other hand, GAD asserted that she rarely reads on-screen, and prints all articles. In this regard, she stated,

*'I print everything. I don't read on-screen. Actually, my eyes are very sensitive and I cannot read for a long time on screen' .... 'Also, I prefer to read on printed paper because it is easier to read the paper anywhere, in any cafe. I do not need to carry a laptop'* (Intvw)

The above statements imply that the respondents prefer to read on printed paper; however, in HEN's case, her discipline affects her reading, and compels her to read on-screen. In DAL's case, her positive attitude towards on-screen reading is driven by a desire to digitise. On the other hand, for GAD, physical factors, such as sight problems and back ache reinforced her printed paper preference.

In relation to reading challenges, in the current study, a comparison of the challenges facing Psychology, Computer Science and Engineering readers when reading reveals that these challenges are similar. One common difficulty that the three readers share results from the L2 language factor; for example, HEN has difficulty understanding the words that are related to Engineering although she is majoring in Nano technology (an Engineering Department). She said

*'Most of the times I need to translate many words and read about new terms to understand what they stand for'* (Intvw)

Similarly, DAL mentioned that

*'I still have to translate the technical terminologies but less than before (.) you know in my field (.) Sometimes I face technical terms in specific contexts'* (Intvw)

Reiterating this issue, GAD explained,

*'The most challenging part of my reading is understanding the vocabulary'* (Intvw)

Another shared difficulty for all three different disciplinary readers is being a slow reader, and taking a long time to read and comprehend a research article. This is explained by DAL who said,

*'I spend a long time reading (.) I do not think that I am a fast reader (.) I wish to improve my reading speed (.) this is one of my problems (.) that I read slowly and take a long time just reading and understanding'*.

Likewise, HEN stated that

*'I still face the problem of being slow (.) Sometimes I take a very long time to read one paper and understand it'* (Intvw)

GAD agreed, reporting,

*'I find it difficult to read on-screen and I am slower at reading on-screen than reading from a printed paper. I cannot concentrate when I read on-screen'* (Intvw)

The ability to critically assess articles while reading is also a challenge for all three students; this is exemplified by DAL who stated that,

*'This is my problem (.) I don't know how to think critically (.) my supervisor asks me about the critical bit of my writing ^ (.) I feel it is the most the difficult part ^ in my reading (.) you know (.) during my Master's I lost lots of marks in my assignments because of the missing critical element (.) I am really poor at critical reading'* (Intvw)

GAD expressed a similar opinion, stating that,

*'I am not very good at critical thinking'* (Intvw)

However, only two of the readers, HEN and DAL, find comprehending content information relating to their discipline of study to be challenging. On this point, HEN explained,

*'I face difficulties from two sides (.) the English language and the content (.) the major'* (Intvw)

DAL also said that she finds it,

*'Very difficult to understand the technical details'* (Intvw)

By contrast, GAD explained that her reading challenges mainly resulted from reading in L2,

*'My problem is the English language (.) I am familiar with most of the information because I have studied it previously, but it was in Arabic (.) Now I need to translate the information to understand it'* (Intvw)

This difference between DAL and HEN and GAD could be due to various reasons; HEN mentioned that her previous study was focused on Physics, while her PhD programme is in Nano Technology, which might be the reason she finds it difficult to understand the content. DAL explained that topics in Computer Science are interrelated, which requires her to read in other areas that are not

related to her specific topic of research, which in turn causes reading and comprehension challenges related to unfamiliar content.

What is surprising about the three readers, and in particular, DAL, who studies Computer Science and is presumably confident interacting with computer screens, is that they find it challenging to read on-screen, due to a lack of digital reading skills. In this regard, DAL stated that,

*'The problem with computer reading is that I have no knowledge about how I can read on the computer (.). I try independently to read on the computer and transfer the strategies that I use when I read on paper to reading online'* (Intvw)

Similarly, HEN explained,

*'I don't use it because I don't know how to do that and I am not fast at typing and writing on the computer (.). Usually I write notes on my printed paper, or in my notebook (.). I find that I am faster when I read using a pen and paper'* (Intvw)

Likewise, GAD reported,

*'When I read on-screen, I easily get bored. Also, whenever I feel bored, I do online shopping; actually, this distracts me from reading and shifts my mind from concentrating on reading and understanding to something else'* (Intvw)

The results suggest that, overall, the similarities between the readers in the three case studies are significant in that the readers share many of the same reading challenges, employ similar sorts of reading strategies and e-resources when reading on-screen, and have similar reading format preferences. In other words, the differences between the three readers are comparatively few; they differ only slightly in their on-screen reading practices as a result of field of study.

These findings do not support the findings of Jafari and Shokrpour (2012) and Park (2010), who found that subject area was one of the most significant factors affecting readers' print-based reading (presented in 2.5.4). However, the results of these researchers were based on print-based reading only, and the researcher does not claim that the present results can be generalised to on-screen reading practices across different disciplines. Rather, this study primarily aims to raise awareness among educators, reading language researchers, and teachers of the idea that readers may need specific help in learning how to interact with on-screen texts and how to make use of e-text resources across different disciplines. In this regard, further research is required to determine the differences in reading across various disciplines.

However, the current study proposes that individual differences may have a significant effect on readers' digital academic strategy literacy (DASL) (see 2.3.1), considering that the differences that

occur based on field of study and individual differences overlap in the current study. It should be noted that this may be due to the small number of participants, which hindered the researcher from defining exact boundaries between the effect of disciplinary and individual differences on students' on-screen reading.

### **6.5.2 Reading and possible effect of individual differences and reading styles – two case studies**

The individual differences and preferred reading styles of two PhD students have been scrutinised; SAR and ALA are studying Computer Science (see 3.9.9 for further details justifying the researcher's choice of ALA and SAR).

ALA's on-screen reading practice is different from SAR's in a number of respects, specifically; motivation, organisation, concentration and confidence. The individual differences between ALA and SAR are indeed affecting their on-screen reading practices. For example, in ALA's case, the sense of achievement and comprehension she experiences when reading print-based papers discourages her from reading texts on-screen. On the other hand, SAR's confidence in her screen reading motivates her to read on-screen, and not to print texts.

With regard to on-screen reading, ALA said that she begins reading research papers on-screen, she writes notes, highlights and sometimes summarises the article all on-screen. However, she mentioned that she still prints the most relevant articles, those that she thinks are particularly important within her field of study, in order to read more deeply. On this point, ALA stated,

*'Usually I start reading on-screen, and then when I want to read to understand and to highlight and underline, I print out the paper (.) sometimes I highlight on-screen, but when I want to understand the article very well I print it out and re-read it (.) I print the important papers that I read fully and I need in my research so I can read and understand them very well' (Intvw)*

By contrast, SAR does not read on printed paper when studying; she mentioned that most of the time she reads on-screen via the software programme 'Mendeley'. She rarely prints papers, only on specific occasions, such as when she meets her supervisors or colleagues to discuss a paper.

For ALA, there are individual reasons that discourage her from reading on-screen, specifically that reading texts on-screen slows her reading and decreases her concentration. She disclosed that her ability to absorb and retain the information within the text is better when she reads from printed materials,

*'Actually, my reading speed becomes slower when I read on-screen, and I cannot concentrate and organise the ideas as well as when I read a printed paper (.) usually when I read the article on-screen it is just to find out about the paper in general, but if I want to concentrate I print it out'*(Intvw)

For ALA, the Internet is primarily for entertainment purposes; when reading online she is easily distracted by other things not related to academic reading, such as shopping or browsing social websites. On this point, she commented,

*'Another problem that I have when I read, and particularly when I read online, is not being able to concentrate (.) I do not concentrate when I read online (.) for example, I might remember that I want to buy something online, so I shop while reading and then return to reading, and then I go and do something else online (.) but when I read from printed paper, I turn off the computer and just read, and when I want to translate a word while I am reading from printed paper I use the phone'* (Intvw)

She also mentioned that most of the time, reading academic research articles on-screen is a challenging activity; she easily becomes bored and searches for another research paper to read. Sometimes she goes back to read the original paper, while at other times she searches for a third or fourth research paper to read. By the end of this process, she is in a state of confusion regarding what she has and has not read. Consequently, ALA found the navigation between texts to be distracting and a confusing approach to reading. On the other hand, for her, reading a printed research paper is a more focused process, during which she reads only one paper and comprehends most of its content.

By contrast, SAR is confident reading on-screen, navigating between web pages and reading multiple texts simultaneously to enhance her reading comprehension. She stated,

*'I use Google to immediately understand the meaning, or Wikipedia, and sometimes I watch a YouTube video, for example about hypermedia, to understand what hypermedia is, and then I return to my paper'*(Intvw)

ALA's reading style involves engaging intensively with the text. She highlights the content of the paper when reading on-screen using the only available colour to digitally highlight and differentiate between the information presented within a paper. Then, she prints out the paper to re-read the highlighted information. Her style of reading discourages her from reading on-screen; she prefers to use multiple colour highlighters to facilitate her second reading of the text. She described this method as follows:

*'Sometimes I read and I highlight and then I realise that I have highlighted most of the paper; that is why I prefer not to read on-screen, as I cannot use different colours to*

*differentiate between the information and categorise it. When I read on-screen and highlight with only one colour, when I need to return to the paper I cannot remember which part is related to the methods or the definition, because everything is highlighted in one colour, so I need to re-read the whole paper again, which of course is time consuming. Therefore I feel more comfortable reading on printed paper; it is easier and clearer' (Intvw)*

Also, ALA's inability to organise her thoughts and reading processes on-screen discourages her from reading on-screen, as is illustrated in the following quote:

*'My problem when I read online is that I cannot be organised (.) I cannot remember what I have read and what I have not (.) I feel confused by the reading and I cannot be organised. Also, I feel lost in all the papers on-screen (.) I feel I am more in control with printed papers' (Intvw)*

By contrast, SAR described her on-screen reading as organised, selective and purposeful. She declared,

*'Actually, I don't read everything (.) I only read the abstract and then the conclusion and specific points in the middle, no need to print and read everything in detail' (Intvw)*

She asserted that on-screen reading is preferable for her, as it is a well-ordered process, in that she can group the research articles and tag them for later referencing purposes. It also facilitates text searches within one research article, or among a group of research articles in her electronic library. In this regard, she stated,

*'I don't read everything (.) I only read the abstract and then the conclusion and specific points in the middle (.) no need to print and read everything in details (.) sometimes if I have specific points in my head and I would like to present them, I only search for evidence for these points when I am reading, so I don't read the whole paper' (Intvw)*

On the other hand, ALA is an intensive reader who reads in a chaotic, purposeless manner, as demonstrated by her quote:

*'Most of the time when I read I realise the paper is not very related to my topic but I read it all because I feel that I may miss an important part of the paper (.) I think this is sometimes a waste of my time, but I prefer to do this' (Intvw)*

SAR explained that her style of interacting with the text is informed by her need to comprehend the text by translating it into her first language. To this end, she copies and pastes the content of the text into Google translator to enhance her comprehension. In this regard, she described,

*'If I was reading a paper and there was some information that I could not understand (.) I would copy and paste it into Google translator, translate it into Arabic and try to*

*understand it in Arabic (.) When I understand (.) I paraphrase and write it in English'*  
(Intvw)

From this quote, SAR appears confident in her on-screen reading comprehension. By contrast, ALA is not so self-assured in her on-screen reading comprehension. She finds that she understands better when she reads from printed paper; she obtains a sense of achievement and comprehension when she interacts with a printed paper, highlights, writes notes in the margins and underlines. This feeling of accomplishment is missing when she reads texts on-screen. In this regard, she stated,

*'When I read from the printed paper (.) I feel that I have achieved and learned (.) maybe the sense of the paper (.) When I revise what I have done at the end of the day and I see that I have highlighted the printed paper (.) written notes (.) and underlined (.) I feel that I have done something valuable by the end of my day (.) but when I do everything on-screen I do not feel that I really studied or learned anything'* (Intvw)

This is not the case with SAR, who summarises, paraphrases and types up information immediately when reading on-screen; her process includes reading and writing synchronously. She said in this regard,

*'When I understand the information, I summarise and paraphrase immediately, in English, and write this in my Word document'* (Intvw)

This is significantly different to ALA's reading style, whereby she reads on-screen, then prints the article for re-reading, and then paraphrases and types her notes on-screen. These findings suggest that although the two readers were studying the same major (Computer Science), they were different in their on-screen reading practices as a result of their different reading styles and preferences.

In conclusion, the case studies presented in 6.5.1 and the present section suggest that reading in different disciplinary areas and individual differences between the readers might have an effect on their on-screen reading comprehension and practices. The most striking result to emerge from the data, however is that major differences might occur as a result of individual differences and different reading styles, while reading style may have an impact on field of study.

The following discussion shows other factors that might contribute to formulate readers' on-screen reading comprehension, practices and changes.

### 6.5.3 Previous reading practices and differences in educational reading system

Findings suggest that the readers' previous reading experiences have a negative impact on their reading practices in the UK. Most of the participants were unaccustomed to reading digitally because of factors related to their previous academic reading practices, namely:

1. Reading only from printed copies.
2. Rarely encountering on-screen academic materials before coming to the UK, and when they had they would automatically print them.
3. The courses did not require them to search and read extra materials.
4. Some lecturers did not encourage them to look for supplementary materials online.
5. Some universities did not have enough computers available for all students, and that they did not always have an Internet connection

In the present study, all readers declared that their previous reading experience had mainly focused on reading printed textbooks and lecturers' handouts. They declared that they had rarely or never had a reason to read research articles either printed or on-screen during their bachelor's study. They justified their behaviour, stating that most teachers mainly depend on textbooks and handouts. For instance, AML reported,

*'All the materials were in hardcopies, even the teachers' power point slides, I used to print them out to read and study because I prefer to draw lines, write comments, and highlight on the paper itself' (Ph1/Intvw)*

Another example was LAM who asserted that she rarely used the computer for academic reading,

*'I don't remember that I used the computer to read academic stuff during my bachelor's degree...because most of my reading were based on books...ahh during my bachelor's degree I was reading social things online, but nothing related to my studies' (Ph1/Intvw)*

In addition, a more detailed assessment of factors which may have led to this kind of practice revealed an important finding related to the education system in the participants' previous academic contexts. For instance, 30% of the readers stated that their lecturers did not encourage them to look for supplementary materials online and stated that their courses did not require them to search for and read extra materials; this was exemplified by MAH, who said:

*'Actually the tutors did not require us to read any extra materials' (Ph1/Intvw)*

Similarly, LAM revealed that during her bachelor's degree, students were relying on reading and studying only hardcopies without the need to search for or read further information,

*'During my bachelor's degree there were computers in the library, and most of the students had laptops, but there was no need to search for any information or to read new information....We were reading and studying specified books that the tutors*

*provided us with during the term...There was nothing about finding new studies or new information in my field...I was just focussing on the tutors' hand-outs and books because of the exam' (Ph1/Intvw)*

REE also stated that she used to rely on lecturers' booklets during her study,

*'Mostly I was reading teachers' booklets...this is a group of hand-outs collected together...Also, I was reading previous examination papers...I was depending on these to know how they present the exam and what kind of questions are on it' (Ph1/Intvw)*

10% of the participants indicated that their universities did not have enough computers available for all students and they did not always have an Internet connection. This was exemplified in HEN's response,

*'The computers and the net were very limited at the university and even in the library' (Intvw)*

It seems that students were not often encouraged to search for information digitally or to read on-screen during their previous studies because the entire educational system tended to be exam-oriented and was based on studying specific hard-copy books. This was exemplified by MAH who said,

*'The evaluation during my bachelor's degree was based on the exam, not on the assignment...and to answer the exam questions...Thus, I only I needed to study from textbooks or the teacher's hand-outs...There was no need to read extra materials' (Ph1/Intvw)*

The majority of the participants did not report evaluating or adding their point of view when engaging in their academic reading either on-screen or on-printed paper. They justified their inability to do this with two reasons; first, lecturers did not encourage them to do so, and second, they had received no instructions about how to read critically either on-screen or from printed paper, for instance, AML declared,

*'all our instructors were not caring about our thinking and point of view they only ask us to bring the answers from another sources and use it as it is (.) the most important thing is to answer the question correctly (.) We used to copy and paste we even use the same sentence structure without any changes' (Ph1/Intvw)*

This suggests that the participants' reading experiences at their home country universities may have had a negative impact on their current reading practices and perceptions of on-screen academic reading in the UK (see 6.5.5 for further details about readers' perceptions). Most of the

participants were unaccustomed to reading on-screen and typically read only from printed copies. They had only rarely encountered on-screen academic materials before coming to the UK and indicated that when they had, they would automatically print them.

These findings therefore reveal that readers need to be prepared cognitively to meet the demands of studying in a different educational context in a digital age; and to be able to face its challenges by having the competences and capabilities of DASL (mentioned in 2.3.1), in particular here for successful on-screen academic reading (see 7.3 for the present study implications).

#### **6.5.4 Length of time of study and contextual factors: Changes in readers' on-screen text interaction**

Incidental to the current study, the data in line with the social constructivist theory mentioned in 2.6.4, shows that readers in the current study developed some changes in their reading preferences and practices as a result of studying in a different context that has different requirements and demands. The findings suggest that today in the UK postgraduate readers read digitally when searching for specific information and when selecting specific parts of the text to comprehend and use for writing, while they print out texts when they intend to read for full comprehension. The study also proposes that some of the readers were aware of the facilities that digital reading provided, but that they still preferred to read in printed paper format. According to the social constructivism theory (mentioned in 2.6.4), this impacted on their academic digital reading practices in their home countries as well as in the UK.

Several factors appear to have contributed to an increase in readers' digital academic strategy literacy (DASL) and changing readers' reading practices in the UK; the need to read extensively, the availability of the network and computer stations, and their desire to be digital readers, attending seminars and conferences, practicing academic language with colleagues, receiving and reading electronic emails from their tutors and colleagues, and responding to their tutors' and supervisors' expectations that they need to read an extensive amount of information to locate the most relevant data independently. All these factors have enriched their content knowledge, enhanced their language proficiency, and thus improved their on-screen reading performance.

To sum up, readers' previous and current academic reading practices and length of study seem to have an impact on their on-screen reading. In this vein, the data suggests differences and similarities between the reading practices of the Master's students during the first and the second phase. It also proposes differences between the Master's students in the first phase and the PhD students. These results confirm the role of and the association between readers' previous reading experiences and factors from their new context in reading practice (see further details about

social constructivism in 2.6.4). A likely explanation for these results is that as students' progress through their programme, frequent on-screen reading practice leads them mastering and having greater familiarity with on-screen texts. However, the current study suggests that completely changing students' reading practices may not be possible by length of study time or by simply making the technology available; readers need to be guided, trained and taught how to use the technology, how to use it most effectively, and to practise using it as the data in the present study (see 6.5.3 for readers' previous reading experience and Table 14, p.314 for participants' digital literacy education) showed that readers had no previous digital academic reading training.

#### **6.5.5 21st century readers' perceptions, preferences and practices of on-screen reading**

Further analysis of the current research study data reveals readers' reading format preferences which are essential in terms of understanding readers' digital literacy, including digital academic strategy literacy (DASL). DASL is concerned with competence; knowledge about digital strategies and how to recognise them, and capabilities; behaviours and practices (see 2.3.1 for further details about DASL). In this regard, analysis of the interview data suggests that reading from printed material was generally preferred over reading from computer screens. The majority of the participants (80%) reported that they dislike on-screen reading while the minority (20%) reported that they like it. Readers who reported that they dislike on-screen reading also reported that they prefer to read from printed materials. The small number of participants who claimed to like on-screen reading had a number of positive opinions about on-screen reading. For further clarification, these results are illustrated graphically in Figure 30, which presents the reasons that some readers prefer to read on-screen rather than from printed paper.

(Continued overleaf)

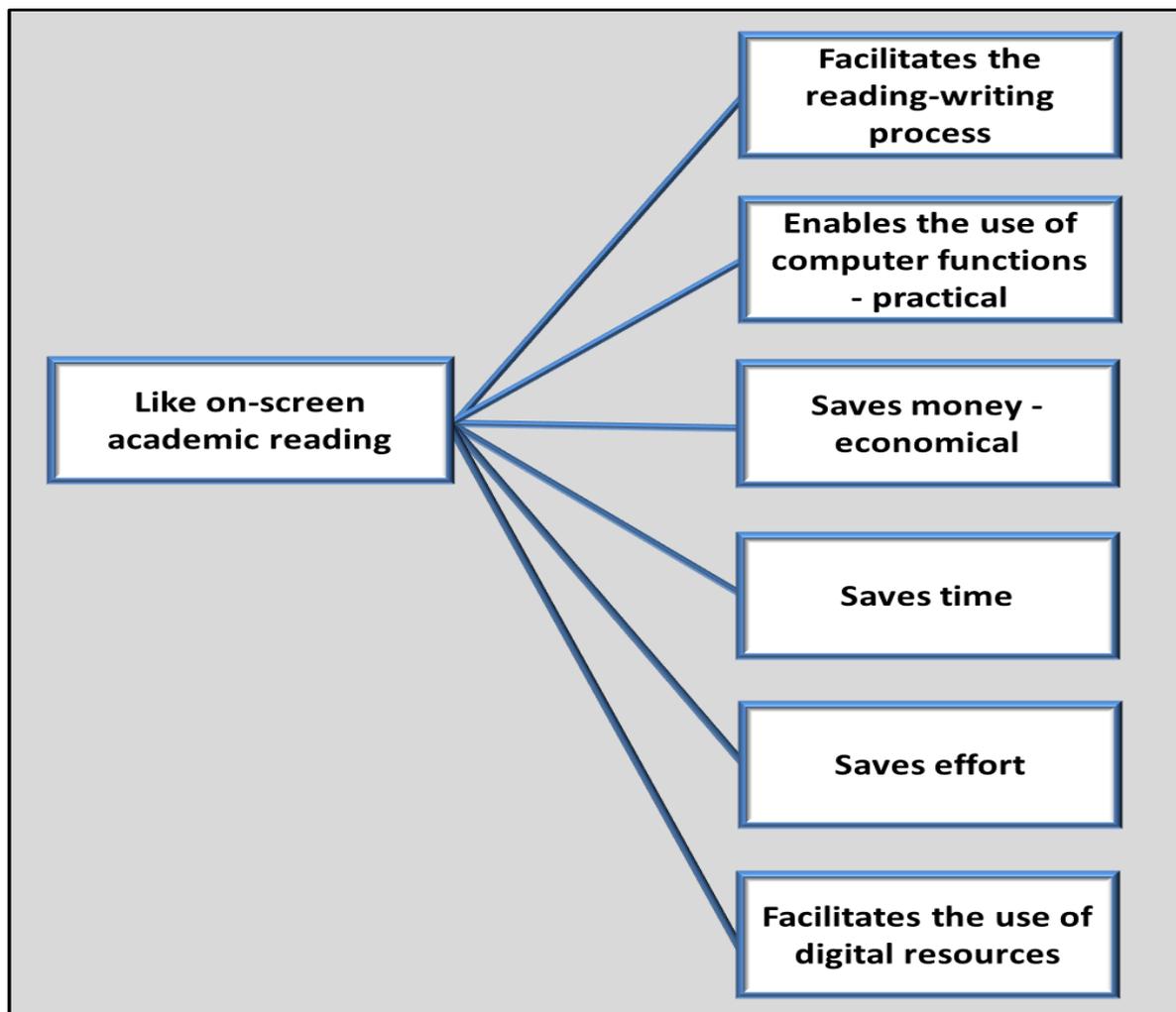


Figure 30: Readers' positive perceptions of on-screen reading (based on the interview data)

20% of the participants reported that they sometimes prefer to read on-screen for several reasons, such as for searching and reviewing purposes. 10% said that it saves them money, effort, time and energy. 15% said that on-screen reading facilitates the use of digital reading resources and the use of computer functions. The participants who feel that on-screen reading has advantages also believe that it facilitates their reading-writing process—that is, it enables them to multi-task during the reading process. They can simultaneously copy, paste, paraphrase, add and modify their writing text. For instance, AML reported that it is more flexible to read on-screen if writing is her purpose,

*'Most of the time I find reading on-screen is easier when I want to write my assignments....I can save time when I read and write immediately'* (Ph2/Intvw)

Similarly, the 20% minority of the readers reported that on-screen reading facilitates the use of digital resources, which can enhance their reading comprehension, such as electronic dictionaries and certain software such as Endnote. In this regard, SAJ stated that on-screen reading enables her to use the computer functions to search for further reading texts and it satisfies her need for information concurrently with her reading comprehension,

*'If I want to search for something in the paper, I copy the phrase or the word and paste it into Google, and then I get several results, instead of writing notes on the paper and then later returning to it in order to enter them in Google'* (Ph3/Intvw)

In addition, MAH stated that on-screen reading is preferable for her as it facilitates electronic translation, which in turn enhances her reading comprehension,

*'Actually the most important reason I prefer on-screen reading is because of the electronic translation (.) it makes it easier and quicker to translate the words'* (Ph2/Intvw)

Also, ALA said that on-screen reading enables her to organise her reading texts in a specific way,

*'Now, by using Mendeley...I can do groupings and add favourites...I put tags on my favourite articles...I use different tags for each group'* (Intvw)

Moreover, 15% of the readers found that reading on-screen saves effort and time and 10% of the readers mentioned that it saves money in terms of not having to pay to print the material—that is, reading on-screen does not require going somewhere to print the document or spending money on hard copies. For example, MAH explained,

*'I found it easier and more practical than spending time printing and stapling, and then I may even throw them out at the end'* (Intvw)

The 20% minority of the readers also found that on-screen reading was more 'practical' in that they could search, save, and read the paper that they needed anytime and anywhere using a computer. For instance, DAL reported,

*'I decided to be a digital person...because I did not want to carry papers with me when I come and go like in the past'* (Intvw)

These beliefs contributed to some of the participants' preference for on-screen academic reading. However, it should be noted that although the 20% minority of the participants who liked on-screen reading did so primarily because of the available resources and digital options, none of them stated that reading on-screen enhanced their reading comprehension because of the digital resources. The data reveals that the participants were reading on-screen because it facilitated their reading; not because these applications impacted their reading comprehension. This may indicate that readers are not aware of the role of digital affordances in improving reading comprehension and even readers who expressed positive perceptions of on-screen reading still find reading from paper sources easier in terms of comprehension.

Readers find that reading academic research articles in a hard copy format is more convenient than reading on-screen. Analysing the participants' perceptions of on-screen reading reveals insights which elucidate the factors that contribute to readers' negative perceptions of on-screen reading; there were two primary elements which influenced perceptions: the text and the readers themselves. For further clarification, these results are illustrated graphically in Figure 31, which illustrates the reasons why some of the readers prefer not to read on-screen.

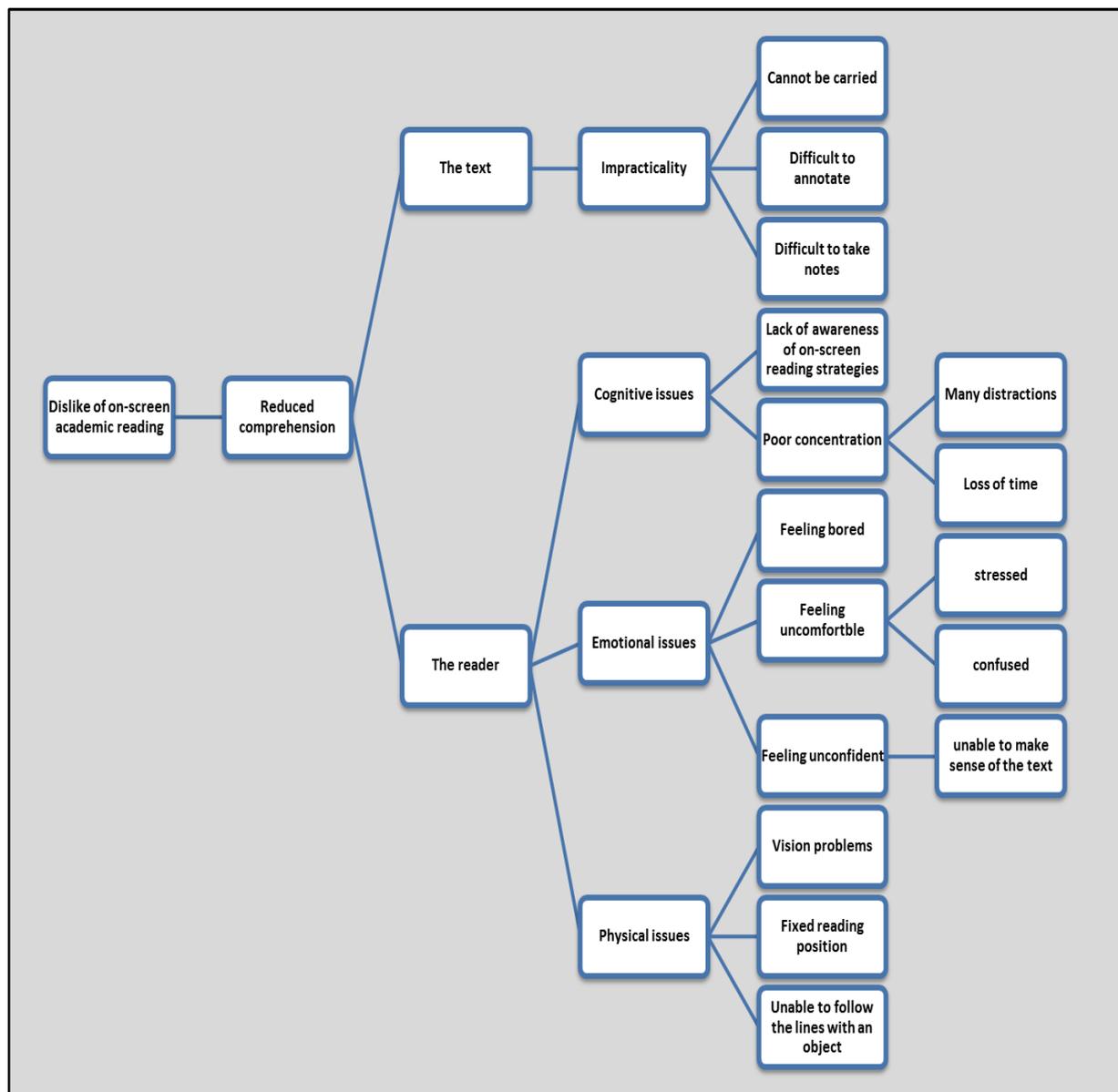


Figure 31: Readers' negative perceptions of on-screen reading (based on the interview data)  
 In terms of factors related to the text, it emerged that the participants found reading on-screen impractical in that it was seen to reduce readers' ability to annotate the text. They felt that marking, highlighting and underlining the text were more challenging when reading on-screen and this was one of the factors that contributed to their dislike of on-screen reading. For instance, SAJ reported that she prefers to highlight using different colours to differentiate between the text content, however, on-screen, she is unable to do this,

*'I use different colours of highlighter when I read a paper to distinguish between the information...for example...this is a definition...and that is methods, etc....but I think this is very confusing and time consuming if I wanted to do it on-screen'* (Ph1/Intvw)

Readers also reported that they disliked reading on-screen text because it restricts their note-taking strategies. For instance, ALA said that making notes on a printed article is more convenient,

*'I can write the notes easily on the printed paper...on Mendeley ... I can write notes, but I feel on the printed material it is easier and more comfortable for me than on-screen'* (Intvw)

Moreover, 25% of the participants indicated that having the text on-screen restricted the number of situations in which they were able to read; that is, they noted that they were unable to carry on-screen texts everywhere and read them at any time as they needed their computers in order to read on-screen and reading hard copy was thus considered more practical in this sense. MAH for example, stated that carrying a laptop for reading is physically more tiring than carrying a printed paper,

*'I can carry the printed paper with me everywhere—on the bus, at home everywhere...I feel carrying paper is easier than carrying a laptop and charger'*  
(Ph1/Intvw)

There were three further reasons given that contributed to a dislike of on-screen reading among the participants which can be associated with the readers themselves. These include cognitive, emotional and physical factors. One of the cognitive aspects involves readers' lack of awareness of strategies for on-screen reading. In many instances, readers reported that they were unaware of, or lacked the knowledge to, effectively deal with on-screen text and this caused them to feel that on-screen reading is more challenging. For instance, DAL declared that she does not know the right strategies to read on-screen,

*'The problem with computer reading is that I have no knowledge about how I can read on the computer...I am trying independently to read on the computer and to transfer the strategies that I know when I read online'* (Intvw)

Participants also found that they were more easily distracted when reading on-screen; the availability of the Internet connection encouraged them to indulge in activities other than their assigned reading, such as searching the web for entertaining websites, checking email, watching YouTube videos or even shopping. Consequently, they lose concentration and waste their time. GAD reported that whenever she reads on-screen, she ends up doing other activities which are not related to her academic reading,

*'I need to check my email and do several things and see my Facebook'* (Intvw)

Similarly, REE stated that on-screen reading is unconsciously related to entertainment, and thus she is unable to concentrate during on-screen academic reading,

*'I tend to associate reading on-screen with entertainment, so when I am on a computer...I search for entertainment stories or sites and read them, but I do not read for my studies...I cannot concentrate because having and being on the net distracts my concentration and reading'* (Ph1/Intvw)

These factors thus cause readers to lose their concentration. For instance, ALA declared,

*'I still lose my concentration very easily when I read on-screen'* (Intvw)

The emotional reasons for the participants' preference for print-reading include the fact that 40% of the readers considered on-screen reading to be boring and did not feel that they sufficiently engage and interact with on-screen text. For this reason, they shift their focus to other kinds of on-screen activities, such as browsing the web, that are unrelated to their academic purposes.

This was exemplified by SAJ who reported,

*'When I read on-screen I get bored easily, and I can do other things on the net to entertain myself'* (Ph1/Intvw)

In addition, the analysis of the data shows that readers did not prefer to read on-screen because they were uncertain of their ability to comprehend it and were often unable to make sense of the text on-screen. For instance, REE reported,

*'I can understand all the details and the information from the printed document while online I only know that material is related to my search and contains important information, but for understanding, I have to print it out'* (Ph1/Intvw)

Similarly, BDR's feeling is that on-screen reading leads to less comprehension and retention than print-based reading,

*'Sometimes I feel that I understand the information and absorb the ideas better when I read printed paper'* (Intvw)

Another issue was that most of the participants found on-screen reading to be uncomfortable and this caused them to feel confused and stressed while reading. For instance SAJ stated,

*'Another problem when I read on-screen is that I lose the lines, and then I need to re-read again and follow the sentences with a pen or something like that. It is confusing'* (Ph1/Intvw)

Interestingly, some readers reported that they need to hold and feel the paper in order to make sense of the text. For instance, AML reported,

*'I need to hold the paper'* (Ph1/Intvw)

Also, SAJ stated that the sense of the printed paper increases her reading comprehension confidence,

*'I feel that I cannot get the information...When I print the paper and hold it while I am reading, I feel confident and able to understand'* (Ph1/Intvw)

These quotes illustrate that readers find on-screen reading emotionally inconvenient. A possible explanation for these findings may be that readers are not familiar with on-screen reading (lack of digital literacy competence and capabilities) and thus they feel bored, uncomfortable, stressed, confused and uncertain of their comprehension.

The final reason for participants' dislike of on-screen reading which is related to the readers themselves involves physical factors. Readers reported that on-screen reading restricts their movement while reading in that they are less able to change their reading position and must stay facing the screen for long periods. For instance, REE declared that changing the reading position is a strategy to enhance her reading comprehension,

*'I prefer to hold the paper and then release it on the desk...I mean I can read differently with the paper rather than on the screen, which is fixed in one place'*  
(Ph2/Intvw)

Similarly, LAY said,

*'...but you know when I am reading on the screen I feel that my hands are not free to move between the pages'* (Intvw)

Some of the readers also reported that reading on-screen can cause vision problems or that they already had vision problems connected with on-screen reading. For instance, HEN declared,

*'I cannot concentrate when I read on-screen because the light of the screen causes irritation in my eyes...this distracts my attention'* (Intvw)

Finally, some of the participants indicated that they prefer to use an object while they read to follow the sentences and that during on-screen reading it is more difficult to apply this kind of strategy, and this may negatively affect their comprehension ability. For instance, SAJ reported,

*'The most important thing about reading print is that I love to follow my reading using my pen or thumb—this makes me concentrate...it is difficult to do this on-screen'* (Ph1/Intvw)

Thus, these three physical reasons (the inability to change reading positions, difficulty tracking the written lines using an object, and vision problems) were the primary physical factors given that discouraged participants from reading on-screen.

In conclusion, the beliefs about on-screen reading discussed above affected participants' feelings towards the two reading formats. The students believed they were better able to comprehend and learn from printed materials than from on-screen sources, reporting that on-screen reading can result in reduced comprehension, more distractions, impaired concentration and reduced

practicality. However, the fact that 80% of the participants reported a dislike of on-screen reading does not mean that they do not read on-screen or are not aware of available digital reading resources. The likes and dislikes that influenced participants' practice of on-screen academic reading and the use of digital affordances during reading consequently shaped their practices related to on-screen academic reading. 90% of the participants indicated that they print articles when reading for detail and read on-screen primarily to search, scan and evaluate the relevance of the content to their specific academic purposes. FAT explained,

*'I usually start reading on-screen, and then when I want to read to understand and highlight and underline, I print the paper'* (Intvw)

Also, AML stated,

*'When I write an assignment...I print all the papers and read them, then I highlight all the sections that I need to write my assignment, and then I type my Word document from the printed papers'* (Ph1/Intvw)

Another participant from the same group, AML, reported that for detailed comprehension, she prints off the article,

*'Mostly I read from printed paper...usually at first I search for the paper, and I read the abstract...after that, if I find the paper has relevant information and may help me in writing my assignment and I need to read most of the paper, I print it'* (Ph2/Intvw)

Similarly, EMA declared,

*'I print the paper because sometimes I cannot focus on-screen'* (Intvw)

Interestingly, one reader, LAY, reported that she never prints long articles or those that use simple language, structure and vocabulary and which require little effort to understand,

*'If the paper is clear, I don't print it. I do not print long papers because it costs a lot of money, and there are many pages. Also, it is difficult to sort them'* (Intvw)

Dissimilar findings on the reading preferences and practices of students have also been established. Liew et al. (2000) investigated eighty-three graduate students' use and perceptions of electronic journals and found that the majority of students (73%) preferred to read electronic, rather than print journals. Bar-Ilan and Fink (2005) conducted a study to investigate the source reading preferences of group faculty members and doctoral candidates from the departments of Physics, Chemistry, Life and Applied Sciences at the Hebrew University of Jerusalem. The researchers used a questionnaire to collect the data. They found that 83.1% of the respondents preferred electronic journals, while the minority (11.9%) preferred the printed format. However, the former study did not scrutinise the reasons behind the participants' choices, as it only relied on a questionnaire without interviewing the participants (see 6.5.5 for present research participants' reasons for choosing specific reading formats). Smith (2003) also used a

questionnaire to investigate the scholarly reading habits of the faculty at the University of Georgia (UGA). The researcher in the former study established that the assistant professors read more articles from electronic than they did from print sources. Smith also found that science faculty members read more electronic articles (77%) than social scientists (69%).

On the other hand, similar findings to the present research have been reported in many other studies which found that readers still prefer and use printed media for many reading activities, especially for in-depth reading (Liu 2005; Mercieca 2004; Young & Gedeon 2000). Liu (2006) conducted a study on graduate students from varying disciplines (including Library and Information Science; Business; Computer Science and Social Sciences) in a university setting, in order to investigate students' sources of reading. He found that graduate academic library users preferred the access provided by online electronic resources for quick search and copy and paste purposes, but printed the electronic documents in order to read them carefully for details and to annotate. The researcher also noted that the frequency of printing the digital documents was similar between the different disciplines. Mercies (2004) interviewed fourteen Business School students concerning their opinions on print-based text compared with three online presentation formats: PDF, Microsoft e-book reader format, and HTML format. He established that the printed page was the students' preferred means of reading as they could easily highlight, annotate and read the text.

A study was conducted by Abidin et al. (2011) using a survey method to determine the impact of online reading on the reading habits of two hundred Malaysian rural secondary school students. It was found that students preferred the printed to the online reading materials. 38% of the participants preferred to read hard copies of newspapers, while only 5% preferred e-newspapers; 24% preferred to read hard copies of magazines and books, while only 6% preferred e-magazines and e-books. Chou (2012) also investigated the digital reading behaviour of five English second language graduate students in different academic disciplines. She concluded with similar results, noting that students preferred to read online when they searched for online sources to use in their writing, and printed out digital materials for deep reading and understanding. Noorhidawati and Forbes (2006) investigated the reasons why students did not use e-books in academic settings and found that one third of the students preferred printed books and one quarter of the students disliked reading on-screen. Rho and Gedeon (2000) found that student readers seldom read the entire article from the screen, although they viewed the Web as a resource to locate academic articles.

In this present study, for instance, the participants skimmed over a Web-based academic article on-screen, printed it out, and then read the printed article. Lynch (2001) has also proposed that students use online resources to browse, to do quick checking and to decide what they do and do not want to read carefully. However, in this study, as in the others discussed above, paper-based texts were students' preferred user interface for reading in depth. This is partially related to the fact that the participants tended to view reading on a computer screen as a skim and scan type of reading. Therefore, overall they did not read long texts on a computer screen or spend much time reading on a computer.

In conclusion, readers' on-screen reading practices are influenced by their perceptions of on-screen reading in which they believe that on-screen reading is for entertainment and surface level comprehension. Their practices are also influenced by their low level of digital competency and capability. Thus, readers resort to printing papers whenever the reading requires more concentration and comprehension. This indicates that readers need more training to have enough competences and capabilities to master on-screen academic reading. The following chapter uses the present study findings to make suggestions for 21<sup>st</sup> century academic reading.

# Chapter 7: **Moving towards 21st century academic reading comprehension**

## **7.1 Introduction**

This chapter has several purposes. The first aim is to bring together the key areas of interest discussed in chapters 4, 5 and 6, by presenting and discussing a sub-element of digital literacy; Digital Academic Strategy Literacy (DASL) in 7.2. The chapter then identifies potential implications for reading skills teachers and reading syllabus designers in 7.3. A suggested model for teacher's reading strategy instruction is also presented in Figure 33, p.296. The bulk of the pedagogical implications came from the data collected from Phase 1 Master's students, which revealed deficiencies in their reading practices. However, the majority of the data overall was collected from Ph2 Master's and PhD student readers, who were more advanced in their academic on-screen reading. 7.4 discusses the challenges of conducting the present research and the limitations that were revealed in 7.5. Finally, 7.6 discusses potential avenues for future research based on the findings of this study, followed by a summary of research findings and the contribution of this study to the field in 7.7.

## **7.2 Digital literacy and DASL**

This research extends knowledge of a sub-element of digital literacy, namely digital academic strategy literacy (DASL). It suggests that digital academic strategy literacy (DASL) refers to a group of literacies that are associated and interacted both independently and simultaneously. This involves information literacy (see 2.3.2) and computer literacy (ICT literacy) (see 2.3.3). Together, these literacies fall under the bigger umbrella of digital literacy. Readers need competences and capabilities in terms of information and computer/ICT literacies in order to achieve competences and capabilities in digital academic strategy literacy (DASL). These include on-screen reading strategies (see 4.2), use of digital affordances (see 4.6), employing both reading processes; top-down and bottom-up (see 4.5), interacting with the academic text according to the hierarchal order presented in 4.3 and the associated reading strategies presented in 4.4; and practicing digital academic reading in order to mastering it.

Interestingly, DASL consists of both on-screen reading comprehension components and print-based reading comprehension components (as presented in 6.4.3, Figure 27, p.256). That is traditional strategy literacy is also a constituent of the digital literacies. In this study, readers employed traditional academic strategy literacy to achieve their academic purposes while reading on-screen. Although the application of traditional digital literacy during on-screen reading has enabled readers to randomly interact with the text on-screen, readers still lack the necessary skills to thoroughly and effectively engage with academic e-texts.

This suggests that a transfer from academic traditional literacy to digital academic literacy is taking place. Print-based reading techniques are giving way to on-screen reading, which requires a level of digital strategy literacy as readers manipulate the strategies that they already aware of and are able to use in order to read a text on-screen. In this study, readers were able to read on-screen and employed similar strategies to those used during their print-based reading. This is reflected in the fact that the readers in the current study reported that they had received no on-screen reading instruction in either their L1 or their L2 as presented in 6.5.3. Their limited on-screen strategic reading competence and capabilities were therefore a result of the transfer that occurred from their print-based reading. In addition, the similarities between the types of strategies employed by readers when reading in the two different media further demonstrated this, indicating that reading strategies are transferable between the two. This confirms the language interdependence hypothesis and the transferability of competency in reading strategies when reading in different languages (see 2.4.4 for further details about the language interdependence hypothesis). However, in this study, the data establishes that a transfer occurred between print and on-screen reading.

Although the results demonstrate that an automatic transfer occurred in readers' cognitive reading abilities in on-screen reading, this transfer was not complete, and readers still found that reading on-screen was not completely effective, due to their inability to interact fully with the text on-screen. The transfer that has occurred between the two text types includes mainly lower-level reading strategies and only a minor proportion of higher level strategies. In this study, although readers read in the L2 either from printed paper or on-screen, they still found it challenging to read on-screen, because their cognitive skills did not completely support a transfer between the two reading formats. The low use of problem-solving reading strategies by readers shows that they do not aim to solve their reading comprehension problems during their on-screen reading as they do during their print-based reading. It also indicates that they do not aim to achieve a deep understanding of the text during their on-screen reading, but rather prefer to get a general idea of the text and to check its relevance to their academic purposes by translating specific words and skipping sections.

The data also suggests that there is a relationship between the increase in readers' traditional literacy and the increase in digital literacy. Readers' increased mastery of print-based reading has helped to increase their mastery of digital reading. However, the improvement was limited to the transfer of traditional strategies to on-screen reading, while the core of the digital academic strategy literacy was not fully present (see 4.6 for readers' use of digital affordances). Relying on traditional literacy and readers' print-based competences and capabilities to interact with on-screen text is therefore not sufficient; and appropriate action needs to be taken in order to improve readers' digital academic strategy literacy (DASL) (see 7.3 for suggested applications to improve readers' DASL).

To achieve an appropriate conclusion regarding readers' current status of digital literacy and be able to contribute to preparing them to attain a better reading outcome on-screen, their preferences were also considered by investigating their perceptions of on-screen reading and their use of the digital affordances while reading on-screen. This revealed surprising results that are discussed in 6.5.5. The literature on the subject of reading research (presented in 2.5.5) and the present research data (presented in 6.5.5) reveal that there is no clear-cut preferred reading source among students. Some research studies give evidence of a preference for digital reading among students, while others do not. However, the present study contributes to changing readers' on-screen reading perceptions and digital academic literacy by providing an understanding of 21<sup>st</sup> century academic readers' on-screen reading practices; and then suggesting the following implications.

### **7.3 Implications for L1 and L2 academic reading in the 21st century**

*'Institutions need to place greater value on 'literacies of the digital', and better prepare their students and their own organizational processes to thrive in an age of digital knowledge practices' (Littlejohn, Beetham & McGill 2012, p.547). 'To place greater value on 'literacies of the digital', and better prepare students, staff and organizational processes for future challenges, universities and colleges need to be prepared to radically change their own practices' (ibid, p.554).*

In order to help universities, colleges, teachers and educators to meet learners' needs in a world embedded with digital tools, the results of this study are discussed in the following section in terms of their pedagogical recommendations, their implications for the 21<sup>st</sup> century and their developmental impact on the L2 reading teaching and learning in a digital context.

Three main implications of the current study are illustrated in detail in the following sections.

1. L1 and L2 reading text books should include instructions for on-screen reading (i.e. language teaching skills text book, Pre-sessional courses text book, an induction courses text book for all students).
2. L1 and L2 syllabus designers, educators and teachers ought to be aware of and use the models proposed in Chapter 4; the model of digital affordances use, the modified on-screen reading strategy scheme (ORSSC), the model of the strategic level of L2 on-screen academic reading comprehension, the model of the patterns of on-screen reading interaction, the model of the patterns of associated sub-strategies, the model of the on-screen reading challenges and the model of on-screen reading components.
3. Postgraduate students must be aware of these models (proposed in the present study) as the basis for their on-screen reading comprehension and must then build on them for their own specific reading purposes.

Several aspects of the current research, such as the reading challenges that can demotivate students to read on-screen and affect their reading comprehension are presented in 4.7. Some of the strategies that they use to enhance their reading comprehension (illustrated in 6.3.5), and readers' perceptions of on-screen reading (presented in 6.5.5) demonstrate the need to facilitate the development of methods to enhance students' reading comprehension in general and on-screen in particular. The objective of this section is to explore the implications of the findings in terms of the potential development of teaching/learning to improve postgraduate student readers' digital academic strategy literacy (DASL), and to allow them to read and interact with academic text on-screen effectively. The present study identified several aspects that are involved in developing readers' digital academic strategy literacy. These are summarised below:

1. An increase in media and information literacies (e.g. using e-resources, dealing with cognitive load, and multitasking) resulted from reading on-screen (see 4.7.1).
2. An increase in reading content knowledge (content schemata)
3. An increase in L2 language knowledge, i.e. general, academic, and technical vocabulary, grammar, and pronunciation (formal schemata) (see 4.7.4)
4. An increase in academic genre knowledge, such as e-books, e-research articles, and e-reports (rhetorical schemata)
5. An increase in digital schemata (on-screen reading competence) (see 6.5.3)
6. Training to read on-screen
7. Practicing several aspects of on-screen reading (see 6.2.2):
  - a. Annotation
  - b. Reading in conjunction with writing (summarising and paraphrasing)

- c. Computer software
  - d. Presentational resources
  - e. Navigation resources
  - f. Illustrative resources
  - g. Dealing with distraction
8. Awareness regarding on-screen reading practices (strategies, cultural and contextual) (see 6.5.3)
  9. An improvement in the speed of their on-screen reading (see 4.7)
  10. Improving critically thinking about the on-screen text content (see 4.7.5)

The following suggestions are based on the findings of the current research and are corroborated by previous research studies on reading. Thus, it is recommended that on-screen reading be carefully considered in L2 reading skill classrooms as it addresses the needs of L2 21st century readers. Recommended methods of promoting readers' digital academic strategy literacy (DASL) are provided below. These are designed for use by both reading teachers and reading class syllabus designers.

### **7.3.1 L1 and L2 reading skill syllabus designers**

The present study aims to shed light on teaching on-screen reading and to motivate textbook designers to design reading e-textbooks that focus on teaching readers on-screen reading strategies based on the present research findings. The purpose of such a textbook would be to help learners in the digital age to develop the academic reading skills that they need to deal effectively with postgraduate-level reading. This textbook should focus on reading on-screen for specific academic purposes, on-screen reading strategies and should include tasks/links for further reading strategy practices.

By observing an L2 reading skill lesson (Khadawardi 2011) and analysing a number of current reading textbooks (e.g. Glendinning & Holmström 2008; Langan 2006; Slaght 2012), the researcher identified that on-screen reading and interacting with e-texts is often neglected in reading skill lessons and textbooks (Khadawardi 2011). In Pakenham's (2011) textbook for teaching reading, however, a brief exercise at the end of each chapter instructs learners to perform online research on a given topic. However, the author (ibid) only instructs the learners to perform an Internet search and says nothing about reading on-screen, which can make a great difference to the way that readers interact with text. In such a case, readers might search for a text and print it out in order to read it.

The combination of the findings of the researcher’s previous study (Khadawardi 2011); and the present study regarding on-screen academic reading comprehension interaction (see Chapter 4 ) suggest recommendations for future syllabus designers. These recommendations suggest an outline for an on-screen reading curriculum but do not discuss the detailed aspects of the syllabus, as this is not the main purpose of the present study. The English for academic purposes for on-screen reading syllabus design should include multiple units organised around specific themes, such as text structure and genre, e.g. e-research articles, e-books, and e-reports (see 2.5.4 for further details about genre and reading). It also should incorporate specific reading strategies for dealing with a text at various levels, such as interacting with the text as a whole, in sections and/ or in paragraphs based on the model proposed and presented in 4.3, Figure 9, p.163. One suggestion for how to achieve the present research implication is to adopt the modified cognitive process dimension of Bloom’s taxonomy (Jisc 2014; Anderson 2005; Orey 2012; Krathwohl 2002). The following Figure 32 presents Bloom’s taxonomy, which describes multiple levels of learning).

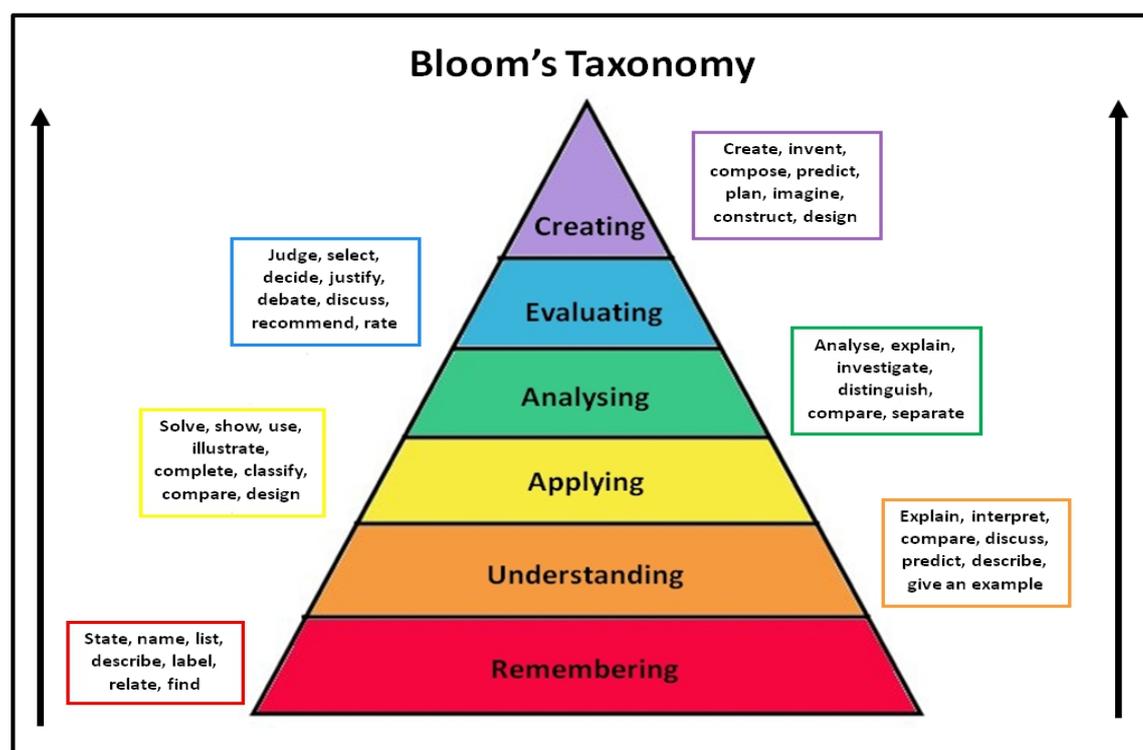


Figure 32: Bloom's Taxonomy - Bloom's Revised Taxonomy, Anderson, Krathwohl et al, 2001 (Jisc 2014; Kolomitro & Gee 2015, p.7)

The first level represents knowledge building, in which the teacher uses different techniques to provide students with information and explanations. This enables students to understand, remember and construct their knowledge. The second level involves applying the taught information, followed by analysing, evaluating and finally creating. Thus, the following suggested elements of the present study are structured according to the modified cognitive process

dimension of Bloom's taxonomy presented in Figure 32, which is argued by the researcher here to increase readers' digital academic strategy literacy (DASL).

1. Explicit on-screen reading strategy instruction
2. Model of reading strategy application
3. Guidelines to practice
4. Independent strategy application (ISA)
5. Reflect, share and create own style of reading

It is argued here that syllabus designers should include this series of five interrelated facets (discussed separately in the following section) to increase readers' DASL competences and capabilities.

### **1. Explicit on-screen reading strategy instruction**

It is suggested that syllabus designers should provide learners with elements of digital academic strategy literacy via a description of the specific types of reading strategies based on various levels of text interaction that are presented in 4.3. This involves three types of knowledge (declarative, procedural, and conditional) for each of the introduced reading strategies (Duke & Pearson 2011; Souvignier & Mokhlesgerami 2006; Spector-Cohen, Kirschner & Wexler 2001). For example, it is recommended that the process and purpose of on-screen note-taking are described and how, when, and where to take notes using the models presented in 4.3 (see Figure 11, p.175; & Figure 14, p.179) are also need to be discussed and practiced in reading skill lessons.

In this regard, Slaght's (2012) *English for Academic Study, Reading Course Book* discusses the importance of using specific sorts of reading strategies. For example, on page 84, Slaght informs the reader about the value of surveying the text before beginning to read for detail. He also provides the learner with guidelines about what to do and when; for instance, on page 6, he illustrates the benefits of considering one's existing knowledge before beginning to read in order to better comprehend the text during the actual reading process. Pakenham (2011), in the *Making Connections* reading textbook, provides learners with all three types of knowledge (conditional, procedural and declarative) in only a few instances, such as in the 'Getting a First Idea About the Article' exercise on page 12. On other occasions, Pakenham provides learners with only declarative and procedural knowledge. For example, on page 63, he explains the value of using a specific strategy (having a general idea about text organisation and content), the procedure to employ it, and then instructs learners to apply the strategy in the reading of a pre-prepared text.

However, it can be argued that adult learners need all three types of knowledge to be integrated into each reading strategy in order to achieve maximum impact and to enable the learner to apply them effectively. This knowledge should also include not only reading comprehension strategies, but also instructions on how to improve language knowledge, such as vocabulary, grammar and pronunciation while reading. Most importantly, it should include information about the use of digital affordances that have been presented in 2.5.5, 2.6.5 and 4.6, while reading. This would raise learners' awareness of on-screen reading strategies, improve their capabilities to use them, and help them to determine which strategy should be employed in which instance and for which purpose.

## **2. Modelling of reading strategy application**

It is argued here that syllabus designers ought to consider including knowledge-based strategies followed by a model of how to utilise these sorts of strategies in syllabi. The procedure for applying specific types of strategies should be illustrated in sequential form as presented in this study's model in 7.3.3, Figure 33, p.296. It is equally important that syllabus designers should take into consideration hyperlinks to pre-prepared video tutorials or/and PowerPoint presentations that display the application of specific reading strategies using pictures and sound.

## **3. Practising**

Syllabus designers should also take into consideration tasks and hyperlinks to online activities that are applicable to various kinds of texts in order to provide learners with guidelines for practising the taught reading strategies and to help them to achieve the Piagetian constructivism concept of learning (see 2.6.2 for constructivism and learning) and the Vygotskian concept of scaffolding in enhancing on-screen reading (for further detail about digital scaffolding see 2.6.5). For example, instructing learners to organise information into a digital mind map, providing them with a flexible template of a mind map and other links to mind map creators. Also, syllabus designers ought to include instructions for learners concerning how to search for a sample text online and how to practise the strategies to complete pre-prepared tasks in order to achieve an authentic reading practice.

## **4. Independent strategy application (ISA)**

Most previous print-based reading textbooks provide comprehension questions that enable learners to practise reading comprehension strategies (Slaght 2012; Glendinning & Holmström 2008; Langan 2006). However, such guided practice needs to be followed by ISA in order to achieve the goal of teaching reading for specific academic purposes. Thus, syllabus designers need to include an activity following each of the controlled tasks, which instructs learners to apply

these strategies on their own self-selected on-screen academic reading text. This would allow the learner to self-regulate, compile and adapt the taught reading strategies to specific texts related to their own field of study. It would help the reader to recognise and formulate the best strategy to employ in some of the most common reading tasks involving academic texts. This method would increase their digital academic strategy literacy (DASL) and enable them to interact with e-text effectively as well as to acquire content knowledge that meets their individual academic needs.

This kind of exercise would promote students' reading comprehension by applying the processes of schema reading theory mentioned in 2.6.3. That is, the students read additional material, learn to locate and evaluate material that is relevant to the reading topic, and practice the taught reading comprehension strategies that involve both bottom-up and top-down procedures, as illustrated in 6.2.2. During this stage, instructions should be provided about the use of specific software programs that record their on-screen reading process, including the strategies that they employ, for use in a later reflective type of practice.

## **5. Reflect, share and create**

Finally, syllabus designers are recommended to include instructions that direct learners to reflect on their reading and comprehension. During this stage, Readers should follow guidelines for effectively reflecting on and thinking about their reading process. For example, learners should be instructed to think about the strategies that they apply to identify the main purpose of a text, write down the strategies that they employ and to think critically about each of these strategies and their usefulness as it was found throughout collecting the data in the present study that stimulating recalls were effective in raising readers' awareness of their employed strategies and allowing them to think about them and modify them (see 3.7.6. for further details about stimulated recalls). It is also recommended that learners should be instructed to work in pairs or/and in groups to compare, discuss and exchange the strategies they employed to comprehend on-screen text. This should trigger the development of readers' digital academic strategy literacy (DASL) and they ought to consequently adapt and formulate the most suitable and ideal on-screen reading strategies in order to achieve their academic purposes.

### **7.3.2 Towards a 21<sup>st</sup> century model of teaching reading**

To date, a solid understanding of how to teach reading strategies in terms of L2 on-screen reading instruction in the 21<sup>st</sup> century is lacking, just as there is a lack of understanding of the concept of digital academic strategy literacy (DASL). The question of what makes teachers of reading skills

successful needs to be addressed. What is needed to make teaching on-screen reading comprehension strategies effective in order to achieve the maximum positive impact on learners?

This study, based on both its own results (finding out what readers do and do not do during on-screen reading; what they need to do to comprehend and why, and the sorts of challenges that they face during on-screen reading) (see Chapter 4) and the previous literature, suggest various implications for the promotion of learners' digital academic strategy literacy (DASL) that teachers may find useful in teaching on-screen reading strategies for specific academic purposes. In this section, three fundamental factors involved in successful digital academic strategy literacy instruction are presented and briefly discussed:

1. Raising readers' awareness of different reading aspects, such as cultural and strategic
2. Integrating technology into reading lesson classrooms
3. Implementing a suggested on-screen reading teaching pedagogy

In this regard, on-screen reading teachers ought to consider the following recommendations:

#### **1. Raise readers' awareness of different reading aspects**

It could be argued that raising learners' awareness is half the battle in enabling them to master reading comprehension strategy skills and to be digital academic strategy literate. Reading teachers need to raise students' awareness of several aspects related to digital academic reading practices. The following notions are suggested to raise readers' digital literacy and in particular, digital academic strategy literacy (DASL) based on three perspectives:

##### **a. Motivational perspective**

Teachers need to raise learners' awareness of the value of on-screen reading in order to increase their on-screen reading motivation. Several studies on reading have cited a positive relationship between high motivation and reading performance (for example Cartwright et al. 2015; Matsumoto et al. 2013; Retelsdorf et al. 2011).

The findings of this study revealed that readers were neither aware nor convinced of the benefits of on-screen reading for overall reading comprehension, and, consequently, were not motivated to read academic texts on-screen. The findings also revealed that most readers had negative attitudes towards on-screen reading (as presented in 6.5.5). For these reasons, it is necessary to raise learners' awareness of the digital affordances and to create positive attitudes towards on-screen reading. Readers need to be aware of the benefits of using electronic sources (see 2.5.5), such as blogs, which research has demonstrated to be effective (Hsu & Wang 2010). Starkey (2012) argues that creating a framework for learning, including questions such as what is being

taught, why, how, where and when, is a source of motivation. Raising learners' awareness of the benefits of on-screen reading and why, when and how to make use of these e-resources would therefore increase their digital academic strategy literacy and motivate them to practise on-screen reading.

**b. Constructivist perspective (Multicultural factors and diverse backgrounds)**

Based on the constructivist perspective (mentioned in 2.6.4) and the findings of this study that are discussed in 6.5.3, teachers need to raise learners' awareness of the similarities and differences between reading based on contextual and cultural demands and practices. The findings of this study suggest that fundamental on-screen reading handicaps may occur if readers are not accustomed to different applications and reading styles and have not been educated about these skills. Learners construct their own understanding based on what they have experienced (Selwyn 2011). In this sense, three factors are involved in learning: assimilation, 'the ability to alter and modify incoming information to fit with what is already known', accommodation, 'the ability to alter what is known in light of new, incoming information' and finally adaptation, in which learners explore and make sense of their context using both notions, assimilation and accommodation (Selwyn 2011, p.73). Teachers thus need to show students that the reasons behind their preference for print-based reading are related to their previous practices and to the simple fact that they are accustomed to it. Readers need to be aware that print-based reading has no direct role in enhancing their reading comprehension. On the contrary, on-screen reading can involve multiple e-resources that could promote their reading comprehension, and learners should be made aware of their value. In addition, learners need to be aware of the similarities and differences between their previous reading practices in their home countries and what is required in their current academic context. Teachers therefore need to teach reading in a culturally responsive manner (Au 2011) and to help struggling readers to understand differences in contextual factors.

Thus, teaching according to the constructivist approach is recommended, as the findings of the current study suggest that different cultural reading practices and expectations of reading in new academic contexts can create challenges for readers (see 6.5.3 for further details about readers' previous reading practices). This approach allows learners to be competent in the required reading practices and comprehension strategies, and these results in greater individual control and more effective reading comprehension and learning capabilities.

### **c. Cognitive perspective**

- I. Raise learners' awareness of the strategies that they need to employ to overcome specific reading challenges.
- II. Raise learners' awareness of the necessity of reflecting on their own reading strategies and ensure that they understand the reasons for using them and how they could improve their use for better comprehension.
- III. Raise learners' awareness of relevant strategies and the contexts in which different strategies would be beneficial.
- IV. Raise learners' awareness of the structure of academic texts. Teachers need to teach them strategies to help them understand the structure of the texts that they will encounter.

## **2. Technological reading classrooms: Enhancing digital academic strategy literacy (DASL)**

In order to enhance students' on-screen reading and DASL; to allow them to be able to make use of digital affordances while reading and to adapt students to read on-screen either in their home country (see 6.5.3) or when they travel abroad to complete their studies, the following recommendations should be followed:

- a. Teach DASL for students (see 2.3.1) as a core skill alongside writing, listening and speaking.
- b. Allow students to bring and use their own electronic devices to practice reading and to exchange information about the different devices they use to read.
- c. Integrate computer-assisted reading strategy instruction (CARSI) into the reading classroom and encourage learners to utilise it outside the classroom; for example, iSTART (Interactive Strategy Training for Active Reading and Thinking) used by McNamara, et al. (2007).
- d. Develop and use computer-based tutorials, which address specific reading comprehension strategies and tasks, such as on-screen summary writing.
- e. Include e-readers in classrooms and motivate learners to use them. It would be beneficial for reading teachers to include e-reader devices in their classrooms (if the funding is available) or to provide reading classes at workstations equipped with computers and screens. Teachers can use these devices to introduce readers to digital reading technology. This is essential in language teaching programmes; pedagogy must include room for and use of technology for reading and using the technological innovations and e-resources under investigation in this study (see 4.6). It is also suggested that teachers use

these devices to motivate students to read extensively, including searching, practising reading strategies, and evaluating on-screen reading resources.

- f. Teach how to use multimedia glossing, how to interact with multitasking, videos, images, supporting texts, and navigate between multiple sources of information; and to overcome on-screen reading limitations (see 2.5.5) and challenges (see 4.7).

### **3. Suggested reading strategy teaching pedagogy**

- a. Teaching reading comprehension based on the interactive approach, including both top-down and bottom-up processing to promote readers' abilities to increase their formal and content schemata (mentioned in 2.6.3). Teachers need to introduce readers to techniques for approaching texts using these two methods. The teacher should make students aware of which types of reading contexts demand each type of processing. For example, in some instances, the reader may need to use a dictionary to understand the meaning of a small unit of text while in other instances; the reader will need to tackle the text from the top down in order to achieve specific goals, such as understanding the overall theme or the purpose of the text as a whole.
- b. Increase extensive and intensive on-screen reading for specific academic purposes.
- c. Encourage learners to read from multiple sources on-screen to enable them to assemble ideas on a specific topic from varying points of view.
- d. In reading for specific academic purposes, reading instructions should be based on readers' self-selected texts to boost readers' content schema (see 2.6.3). Teachers should instruct students to apply the taught strategies and practise using them on their own self-selected texts. The teacher gives learners a task and the associated strategies to achieve specific reading purposes, and then the students practise and extend these strategies to their own self-selected texts and employ different strategies based on their own needs and preferred reading styles.
- e. The results of the current study reveal that the actual process of reading requires not a single strategy at a time but rather involves a combination of associated strategies. Thus, teaching ought to include lessons on how to use particular combinations of strategies in addition to one at a time (as mentioned in Figure 11, p.175).
- f. The direct explanation approach (DE) involves explicit instruction of on-screen reading strategies, including how, when, and where to utilise them. Several researchers have found that explicit instruction is an effective and powerful means of teaching reading

strategies (e.g. Almasi & Fullerton 2012; Duke & Pearson 2008; Farrell & Farrell 2008; Jones & Clark 2014).

#### **4. Reflecting, thinking, sharing and creating**

The modifications and the added elements are based on the concept of transactional strategy instruction (TSI), which focusses on providing explicit instructions as well as facilitating discussion and interactive exchange between learners (Williams 2011). In the suggested element of the model, explanation of the strategies and discussion, either internal (within the learners themselves in terms of their thoughts), between the learners, or with the teacher, should be considered. This is exemplified in MAH's case during Intvw1 when she was asked about the language she used in her private thinking, whether it was the L1 or the L2. During the interview, MAH mentioned the realisation that when she transfers information into her L1 when reading in the L2, this process slows her down. She also noted that minimising this code switching between L1 and L2 may improve the speed of her reading.

Therefore, the researcher in the following section suggests a model involving explicit on-screen reading instruction that needs to be tested further by other researchers and educators.

#### **7.3.3 Theoretical model for teaching reading strategies**

The theoretical model proposed below is based on the work of Pearson and his colleagues (Duke & Pearson 2002), 'explicit description of the strategy, modelling of the strategy in action, collaborative use of strategy in action and guided practice' (p. 208-209). A modified version of a similar model has also been introduced by Eagleton and Dobler (2012) as an element of effective instruction for learning on the web, including modelling, scaffolding, practising and feedback. For the current study and to achieve the present research indirect aim which is promoting on-screen reading, two models have been further added, namely reflecting, thinking and sharing; and practicing, creating and practicing

The following suggested model reflects the sequential steps of a suggested design for on-screen academic reading comprehension strategies instruction which constitutes one component of teaching DASL (see Figure 33, p.296 for further illustration and see the following sections for its explanation). Each of these facets in the suggested model includes sub-elements presenting the actual procedure. This suggested model includes the following interrelated facets:

1. Explanation
2. Modelling

3. Practising, collaboration and scaffolding
4. Reflecting, thinking and sharing
5. Practicing, creating and practicing

These elements are presented in detail in the following section.

(Continued overleaf)

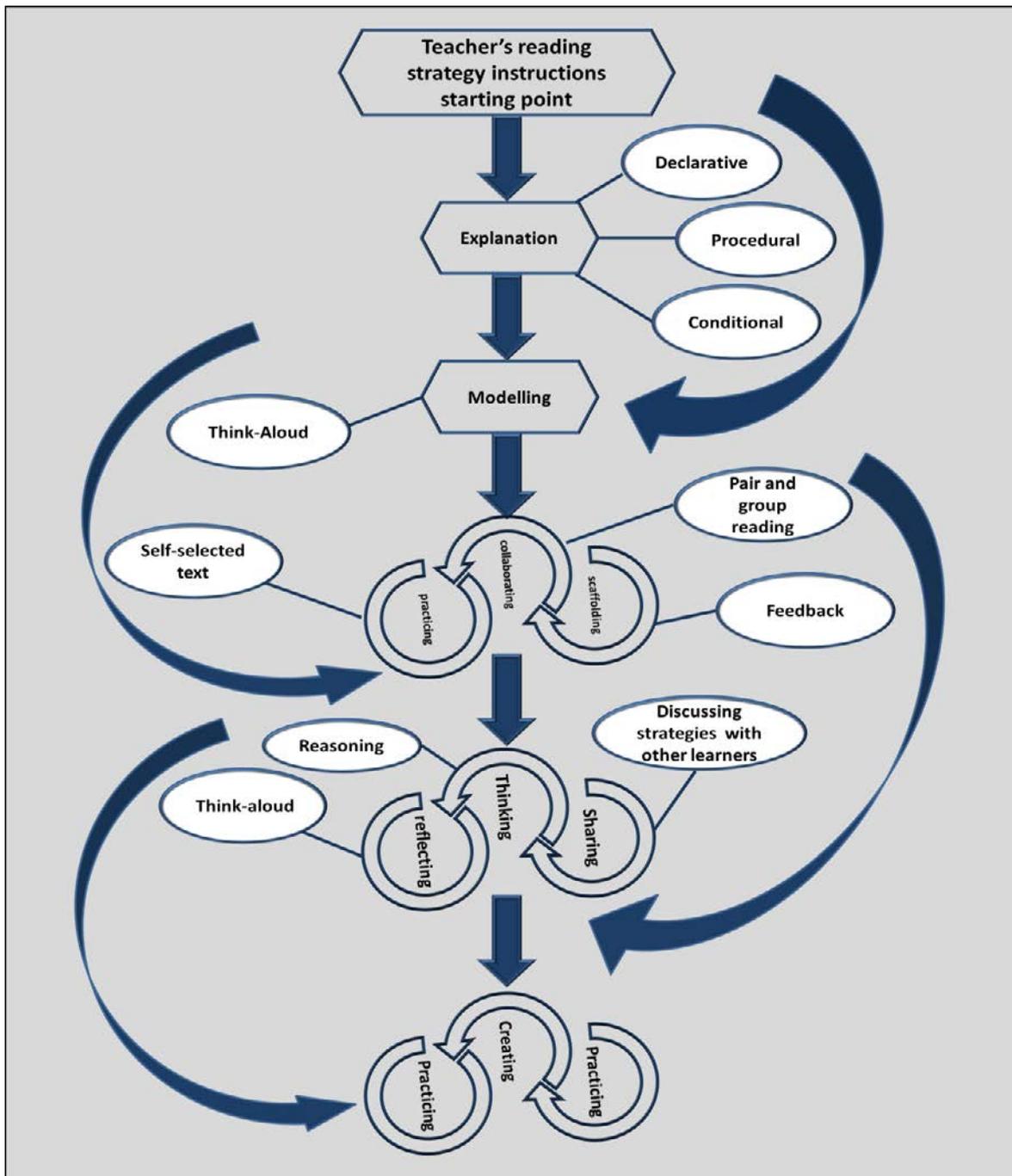


Figure 33: A Proposed model of teacher's reading strategy instructions

1. **Explanation:** The teacher provides explicit descriptive knowledge about the reading strategies to be taught, including declarative, procedural and conditional knowledge. This knowledge is based on the type of strategy, why it is used, when it is used and how to implement it in a specific situation along with why it is helpful and how to perform the strategy in order to raise readers' awareness of on-screen reading sub-strategies (see Table 7, p.141), hierarchal interaction with on-screen text (see Figure 9, p.163) and associated strategies (see Figure 11, p.175).
2. **Modelling:** After the explanation process, the teacher demonstrates the strategy by performing a think-aloud exercise, vocalising thoughts that occur while reading. In other

words, the teacher models the cognitive processes that occur while interacting with a text using the models suggested in chapter 4.

3. **Practising, collaborating and scaffolding:** This is the stage that readers read and practise the taught strategy in pairs or in groups using self-selected texts. During this process, the teacher plays the role of guide; scaffolding learners' reading strategies (see 2.6.5 for further details about scaffolding). The teacher provides the learners with feedback and enables them to evaluate their own use of strategies. Over time, the teacher gradually transfers responsibility for interaction to the learners themselves until they are capable of engaging in the process entirely on their own.
4. **Reflecting, thinking and sharing:** The teacher encourages the learners to think aloud and to reason strategically when they encounter barriers to comprehension when reading. Readers think about and discuss mental processes and cognitive strategies, creating interactive exchanges between learners in the classroom.
5. **Practicing, creating and practicing:** At the end, readers should be able of creating their own style of interacting with e-texts effectively and practicing it.

Applying this proposed model could have a positive impact on readers' ability to use reading strategies, allowing the independent application of on-screen reading strategies while reading academic texts. However, reading teachers need to be aware of several factors in order to be able to provide effective instruction for on-screen reading:

1. The differences between readers' previous reading experiences and the demands of their current context.
2. Learners' previous academic reading experience.
3. The value of using technology in reading classrooms.
4. Methods of applying technology in reading classrooms.
5. The potential of hyperlinks and e-resources to support reading comprehension strategy instruction.

Teaching comprehension strategies effectively involves a level of proficiency and flexibility that often requires substantial and intensive teacher preparation. Implementation of effective comprehension instruction is not a simple matter; substantial teacher preparation is usually required for teachers to become successful at teaching reading comprehension. There is a need for greater emphasis in teacher education on the teaching of reading comprehension strategies. All this may highlight a need for teacher training and workshops to acquaint teachers with

techniques and strategies to enhance learners' on-screen reading and to design suitable on-screen reading activities and implement them successfully in the classroom.

## **7.4 Challenges of conducting the current research**

The researcher encountered various challenges during the research process. In addition to recruiting participants, organising the practical aspects, such as booking a room within the library, contacting computer services each time to reserve the video camera in advance and arrange suitable times for each participant to come, other sorts of challenges arose during the actual data collection process.

One of the challenges that the researcher experienced while conducting the think-aloud protocol was related to readers' verbal expression of thoughts. Although the participants were given a short training session and generally began by vocalising their reading strategies and inner thinking as they were supposed to do, some participants unconsciously reverted to talking about the content of the reading, which was not relevant to the purpose of the study rather than the reading process. In the same vein, some of the readers seemed to have difficulty transforming their inner thoughts into articulated words and remained speechless during most of the reading tasks. Therefore, during the think-aloud protocol, the researcher had to cautiously observe the readers and note potential unarticulated thoughts and prepare questions to ask during the stimulated recall sessions in order to seek clarification from the readers. This process was a strenuous task for the researcher. In addition, during the SR, the researcher had to watch the video recording with the readers and involve them in unprepared, spontaneous discussion. These processes were highly demanding and somewhat difficult for the researcher.

In addition, analysing the interrelated and the overlapping data from the different methods was a challenge for the researcher. For example, some of the instances from the think-aloud protocols were explained during the SR, and 30% of the readers provided extensive retrospective examples from their reading task during the interview sessions.

Another challenge was dealing with the massive amount of qualitative data. First, watching all 45 video recordings, each 20 minutes in length, was extremely time-consuming. The researcher also had to replay the videos several times in order to achieve the most accurate analysis possible. In addition, most of the videos had to be transcribed into written documents for analysis (see 3.9.1). Finally, listening to the 45 audio recordings of the SR sessions and transcribing them was also laborious and time-consuming.

Moreover, the process of data analysis was both time and effort-consuming; the researcher had to peruse the data and conduct the analysis several times in order to achieve precise results. First, the researcher had to be very rigorous in identifying themes in the qualitative data and in analysing and categorising the data according to these themes in order to find patterns across the range of participants. Then, the researcher had to review the deductive and inductive themes within the analysed data and scrutinise the data to find overlapping strategies between different functions. Finally, the analysis was revisited to identify the frequencies of strategy use and to review the accuracy of the data analysis. On the whole, conducting research on reading skills and investigating the reading strategies that learners employ was not an easy task. It required much effort, time, training and consideration.

The following section discusses the limitations of the current study, including those related to generalisation and methodology, which are interrelated in a few aspects and have some effects on the reliability and the validity of the results.

## **7.5 Limitations of the current research**

Although this study provides valuable insight into digital literacy (DL), L2 academic on-screen reading and digital academic strategy literacy (DASL), it nonetheless has several limitations. The first involves the methodology. The study attempted to analyse readers' cognitive processes based on their illustration/verbalisation of what they were doing and their thoughts during the actual reading process. The quantity of data is not considered critical in this research because the method of collecting data is mostly qualitative and depends on the performance and the response of the readers. However, some participants produced more responses than others. They elaborated in greater detail about their reading strategies and provided rich information while others did not. This was not necessarily because they did not use strategies or know how to use them, but could also be simply that some individuals prefer to talk less. It is therefore impossible to know for sure that one person uses more strategies than another based purely on what they say during TA and SR. The use of eye tracking, however, could allow the researcher to obtain additional evidence of readers' used strategies and could help stimulate a more comprehensive explanation from the reader.

Another limitation of the current study is the need to be cautious about the generalisability of the findings due to the methodology used, including the type of text selected for the research and the electronic device that was used for digital reading. The researcher chose a research article for the readers related to their field of study and a laptop screen as the medium of presentation because

this is the type of text and device most commonly used by university students. However, the research article represented only one of the types of text commonly encountered in the academic domain, and readers may interact differently with other types of academic texts, such as books and reports. Furthermore, several other types of electronic devices are commonly used, such as Tablets, and learners may engage with texts differently based on the device used.

The current study focused on only one type of reading task, namely reading for comprehension. The singular purpose of the task limits the reading strategy findings, as readers may react differently and employ different strategies if required to read for other types of academic purposes, such as writing or preparing for participation in a lecture.

As the study genuinely concentrated on the process of reading and produced valuable results, however, this could limit the research in a sense that the product of the reading process was not assessed or measured statistically in relation to the strategies that the readers employed to comprehend the text. Thus, it could be beneficial to investigate both aspects (process and product) to achieve results that are more comprehensive.

The relatively small sample size and the population of the present study, which was intended as a case study whose main purpose was to investigate the reading comprehension practice of a specific group of students in-depth, is a limitation. The sample of twenty students was adequate to achieve the research goal; however, such a small sample cannot accurately represent the wider population, making generalisation difficult to achieve.

In regard to the sample criteria, there are several factors that could have been further controlled. In the current study, recruiting the participants from various disciplines successfully has enabled the researcher to spotlight and investigate the possible effect of disciplines on readers' reading practices. However, focussing on specific areas and involving students from only two or three disciplines could strengthen the reliability of the results and reveal differences between the reading practices of students from different areas of study. It could also help to distinguish between the effects of individual differences and discipline differences on learners' reading practices. The final factor concerns the participants' gender. In order to avoid the gender effect on reading, it was decided to include only female participants. However, different genders could reveal interesting findings.

Finally, conducting research in the field of L2 reading processes has the complication of requiring the mutual efforts of both the participants and the researcher. Many students are generally unwilling to spend time reading articles, even when this meets their own purposes and particularly when they are asked to make an effort to verbalise their thoughts during the reading

process. These requests might weaken the readers' motivation to engage fully with the reading tasks, and at the same time, the researcher may tend to prolong the activity when objective and reliable results are sought.

## **7.6 Proposed direction for further research**

Continued in-depth research into digital literacy, on-screen reading, interacting with e-texts and DASL seems justified because of the shift that is occurring toward more and more digital reading. The continued increase in digital publications, the availability of digital books and electronic 'smart' devices and the consequent ubiquity of e-texts in our daily lives make it an essential time to continue investigating on-screen reading practice. In addition, the researcher encountered several ideas for future research while conducting this study, which could also compensate for the limitations of the current research discussed in 7.5. Several possible directions for future research seem particularly promising.

This study focussed on identifying the comprehension reading strategies of postgraduate readers while reading academic research articles on-screen in their field of study. While this study did provide a snapshot of the readers' interaction with an academic research article, further research needs to be done to compare the strategies that readers employ when reading other sorts of academic texts, such as books, lecturers' slides and reports, in order to determine the strategies necessary to effectively interact with different types of e-texts and achieve academic success. Consequently, further research into the different interactions that occur between on-screen reading for various academic purposes as well as for entertainment is also necessary to extend our knowledge of how learners' reading purposes affect their on-screen reading.

The current study focussed on identifying the reading strategies employed while reading from a computer screen and analysed the types of strategies and their frequency of use along with the e-resources that readers' use as references. However, it could be interesting to compare between the strategies employed and the use of e-resources when reading from various devices, such as e-books, Smartphones and Tablets. In addition, it could be interesting to identify the effect of different kinds of electronic screen 'ink' on readers' attitudes and interaction with e-texts.

As the current study's focal point was the process of on-screen reading only, it is still necessary to assess reading comprehension outcomes in order to obtain a definitive answer indicating the most effective format (print or on-screen) for reading comprehension. Thus, a recommendation would be to look for associations between readers' answers to specific comprehension questions

and the employed on-screen reading strategies in order to identify the best strategies for achieving different levels of comprehension. Thus, the learning outcomes of the two mediums could be tested and compared in order to obtain reliable answers.

As mentioned previously, the present study targeted the process of reading and revealed that reading on-screen provides readers' with the opportunity to utilise e-text resources during the reading process. Considerably more work needs to be done to determine the relationship between the use of digital affordances while reading on-screen and the comprehension outcomes of readers. It is necessary to understand how the use of digital affordances increases (or perhaps even decreases) learners' reading comprehension while reading on-screen. Further experimental research could therefore be conducted to compare the use of e-resources with not using them on reading comprehension outcomes.

This study used a qualitative approach to investigate the reading strategies of 20 postgraduate students. The additional use of quantitative techniques to reveal the reading strategies of the same sample of students could provide cross-correlations. This could contribute to more reliable results, revealing readers' awareness of the sort of strategies that they employ during on-screen reading. As this study focussed on a small number of students, the researcher is interested in comparing the results with a similar study involving a larger sample of postgraduate students. Thus, a follow-up study with a larger number of participants studying the same subject could provide a significant contribution to the field and could allow greater generalisability of the results.

Finally, numerous on-screen reading studies have been conducted regarding both reading in the first language and in a second language (e.g. Ramli, et al. 2011; Sharmin, et al. 2013; Stoop, et al. 2013; Taipale 2014; Zhang, et al. 2008). The current research focussed on comparing on-screen reading with reading from printed paper in a second language. Future research in this vein of inquiry might consider a comparison between the on-screen reading that occurs when learners read in their first language as opposed to a second language.

The findings of the current research reveal a need to conduct further and more in-depth investigations as the current results seem to invite more questions than answers:

1. Replications of this investigation on different groups of readers and different age groups could help to achieve a better understanding of the effects of developmental level and age on on-screen reading practices.
2. While the current study opted for an open-ended task (reading for comprehension), a more directed learning task, such as finding a discrete piece of information or solving a

specific comprehension problem, may cause readers to engage with texts in an entirely different manner.

3. The thesis has not taken into consideration the influence of multiple reader-specific factors on reading practices and the use of cognitive operations; the findings suggest that there are relationships between certain individual characteristics and reading, such as the desire to develop digital skills. Thus, research on the various on-screen academic reading styles, individual academic reading preferences, intrinsic and extrinsic motivation, gender, and the effect of field of study on readers' attitudes towards on-screen reading and the reading strategies that they use is necessary to elucidate the role of these factors in developing on-screen academic reading practices.
4. The relationship between print reading and on-screen reading strategies and the theory that transfer occurs between reading strategies in the two media formats is another area of shortcomings that warrants further investigation.
5. Continually monitoring the changes in readers' perceptions, preferences and methods of interaction with texts on-screen over a long period is needed to reveal the effect of time on learners' reading practices.
6. A comparison of undergraduate and postgraduate students' on-screen reading strategies is necessary to discover differences and similarities between different levels of students.
7. Investigating the positive and negative effects of the multi-tasking dimension of on-screen reading on comprehension and learning would also provide useful insight.
8. Investigating the differences and similarities between reading in L1 and L2 and their effect on readers' reading intelligence and criticality.
9. Identifying readers' digital literacy by removing all the constraints during reading, providing them with a flexible reading task and placing the readers in labs equipped with different reading devices or/and software. Giving readers no constraints and the flexibility to interact with the text using a variety of means of their own choice would reveal aspects of their digital literacy.

For further progress to be made in the research of on-screen academic reading, such areas as these are worth exploring in order to get closer to an understanding of the factors and processes underlying on-screen reading and digital academic strategy literacy (DASL).

Despite the various limitations and caveats, the findings of this study contribute to the body of research investigating on-screen academic reading comprehension. It is hoped that the main

questions of the study have been adequately addressed, some new lines of further inquiry have been suggested and a contribution to the field has been made.

## **7.7 Research summary and contribution**

This final section of this thesis looks at the contribution of this research to on-screen academic reading comprehension. The thesis presented findings regarding which types of reading strategies were most and least-frequently used when students read academic texts on-screen and from printed paper based on the Think-aloud (TA), stimulated recalls (SR), researcher's field notes (FN) and interviews. The TA and SR sessions revealed qualitative explanations of the kind of reading comprehension strategies that readers utilised to support their reading comprehension, solve a problem, evaluate the text, and/or approach the text globally. In this regard, it was found that print-based reading was more effective and led to greater comprehension and learning than on-screen reading as it was found that readers employed more strategies and interacted more deeply with printed text than on-screen text. In other words, it has been concluded that readers may not aim to solve their reading comprehension problems as often during on-screen reading as they do during print-based reading. It also seems that they do not aim to obtain a deep understanding of text during on-screen reading but rather to gain a general idea about the text and check its relevance to their academic purposes by translating specific words and skipping sections.

The study has also suggested a new version of on-screen reading strategy scheme (see 4.2, Table 7, p.141). An on-screen reading interaction model (see Figure 10, p.173) and another model presenting the associated strategies used during on-screen reading have been formulated and proposed throughout the study (see Figure 11, p.175). A model presenting various sorts of strategies has been analysed and categorised according to the hierarchical level of text content, namely strategies associated with comprehending a text as one unit or in terms of sections, paragraphs, sentences, phrases and words (see 4.3). A model presenting the use of digital affordances (see Figure 14, p.179) has also been proposed, and it was concluded that on-screen reading often involves the use of e-resources to enhance comprehension. However, the utilisation of e-resources by this particular group of student readers is considered low.

The findings also revealed the strengths and weaknesses of international postgraduate students when reading L2 digital academic materials, particularly research articles in English in their fields of study. The challenges of reading L2 academic texts on-screen have been examined in order provide researchers, educators and teachers with a clear understanding of the on-screen reading challenges that readers experience which demotivate them to read academic text on-screen. It was demonstrated that readers may experience several sorts of challenges, such as facing

unfamiliar content and lacking familiarity with on-screen academic reading strategies (behavioural issues). Thus, the thesis brought to light the challenges that readers experience during on-screen and print based reading (see Figure 15, p.191; & 4.7 & 5.3) followed by some of the approaches that readers utilise to overcome on-screen reading difficulties (see Table 9 & Table 10, p.247-248). On-screen and print-based reading processes were also compared, and it was found that both reading formats generally involve interaction between top-down and bottom-up processes. However, the data suggests that on-screen reading tends to require more bottom-up than top-down processes (see 6.4.1 for further explanation).

The researcher then investigated what source of materials (whether printed or on-screen) students actually used when they read academic texts. In this regard, the various responses revealed that on-screen reading is generally based on the individual reader's purpose. In other words, if a reader's aim was to search for information, evaluate the appropriateness of the text, skim, and/or read to write, they read the text on-screen. On the other hand, when they wanted to read for deep comprehension, they tended to print out the text. The researcher has also focussed on the interview findings regarding the participants' relationship to on-screen academic reading. Student readers' views on on-screen reading were presented and it was concluded that most readers prefer to read printed materials over on-screen ones for several reasons (see 6.5.5 for further details).

Regarding readers' perceptions of on-screen reading, the present study found that 80% of student readers preferred to read printed text and had a general conception that on-screen reading was essentially challenging, preventing them from achieving sufficient comprehension. This conception was explicitly confirmed by their practices, limited interaction, and strategy use when faced with on-screen text as presented in Table 8, p.226. They tended to print out articles that were long, complicated or seen as particularly relevant to their academic purposes. They do not aim to gain a deep and critical understanding of text during on-screen reading, but rather to gain a general idea about the text and to check its relevance to their academic purposes via strategies such as translating specific words and skipping sections. Close reading of academic articles on-screen was thus not commonly practised amongst the postgraduate readers in this study; rather, they tended to read on-screen only in order to obtain an overview of a text and printed it out when deeper comprehension was necessary. It is possible that readers' perceptions presented in Figure 31, p.274 of both reading formats contributed to their on-screen reading interactions, causing them to employ fewer strategies during on-screen reading than during print-based reading.

The study shows that although other readers have a level of digital strategy literacy as they seem aware of the benefits of on-screen reading and are familiar with some of the on-screen text resources, when it comes to capabilities, practice and actual reading, they prefer to read from printed paper.

Part of the study was thus devoted to a discussion of the factors that shape readers' on-screen reading perceptions and practices. To achieve this, multiple case studies were analysed. The present study revealed that disciplinary and individual differences might also have an impact on readers' perceptions and practices. First, three readers studying in different disciplines were compared, revealing the possible effect of differences in field of study on on-screen reading practices. Second, two readers studying the same major were also compared, revealing the possible effects of individual differences on readers' on-screen reading practices. It was also found that readers' previous and current reading experiences contributed to their perceptions and practices of on-screen reading. Finally, it was demonstrated that two other factors may have an effect on students' on-screen reading; previous study, length of study and current academic reading practices.

In this regard, the current study suggests that reading does not stand alone, instead it is contextual. That is, it is not only readers' area of study that may have an effect on their on-screen reading; individual differences, such as motivation, physical and behavioural issues, on-screen reading conception, confidence and capabilities along with previous and current academic reading practices in specific contexts, are all factors can influence students' on-screen reading perceptions, preferences and practices. Moreover, the participants' period of study seems to have had an effect on their perceptions of on-screen reading and their related practices. This was revealed by comparing the second phase Master's students' perceptions of on-screen reading with those of first phase Master's students and by comparing first phase Master's readers with PhD student readers (see 6.5.4).

Thus, this study can be said to be valuable as it contributes to research into digital literacy, academic on-screen reading and digital academic strategy literacy (DASL) in particular. It could also be a unique study as it investigated reading from both cognitive and socio-cultural perspectives. In addition, to the best of the researcher's knowledge, it is the first study to investigate postgraduate international students' L2 digital academic reading comprehension in the UK educational context. It contributes to knowledge about L2 students, in particular postgraduates, by investigating their L2 on-screen academic reading practices and the issues that they face in this context while studying abroad. The findings from this thesis contribute to better

preparation of L2 postgraduate students for the academic digital reading era and provide them with access to the most effective reading strategies for reading L2 digital academic documents.

In addition, the findings of this study and previous research allow the researcher to draw the unexpected conclusion that print-based reading is more conducive to learning than on-screen reading. Before beginning the current study, the researcher's hypothesis was that on-screen reading is more effective and leads to greater comprehension and learning than print-based reading because of the affordances provided by the number of resources available when engaged in on-screen reading. However, the results of this study suggest that print-based reading is more efficient than on-screen reading for the participants in this study.

It is true that reading on-screen has some differences in comparison with reading on paper and maybe a specific age group of students in the current digital age are not digitally academic literate and do not have the capabilities and the strategies that they should have to employ the digital affordances for their benefit and thus they are not going to be effective readers during on-screen reading. This must change. This is a transitional period; knowledge presentation and technology are changing and developing; and students (not only Saudi) need to be trained as they are not prepared and trained to interact with the academic technological world. The outcome of the current study and the proposed models presented in chapter 4, are an attempt to at least start considering on-screen academic reading in L1 and L2.

Consequently, this study has provided practical suggestions regarding the reading curriculum and instructions to illuminate postgraduate students' reading weaknesses (presented in 7.3). From these outcomes, it is hoped that language courses, digital skills courses, the Ministry of Education in Saudi Arabia and those who are in charge of preparing students to study abroad in any part of the world will respond to the research recommendations and make efforts to prepare students for the L2 digital academic reading demands that they may face in a L2 digital educational context.

In summary, this research contributes knowledge and presents models that help researchers and educators to understand the digital L2 academic reading practices of international students which it is hoped will lead to improved preparation of international students in this changing world.

Thus, this study ultimately contributes positively to the field of teaching second/foreign language digital academic reading to university students, making it timely, critical and significant. The outcomes of this study and the presented models will also benefit other international students who come from different educational contexts and who have different reading experiences. It will help them to be prepared and to improve their L2 academic reading prior to starting their

postgraduate studies in the UK. Therefore, the current study contributes to global research by attempting to prepare and equip foreign language postgraduate students who are going to study abroad with the necessary competences and capabilities to read digital English academic materials efficiently in the 21<sup>st</sup> century. Thus, the most important aspect of this study is its contribution to the new field of L1/L2 digital literacy, by identifying digital academic strategy literacy (DASL), which helps to better understand the requirements of on-screen academic reading comprehension in the 21<sup>st</sup> century. This thesis has been able to propose and determine certain elements of digital academic strategy literacy (DASL) and has presented tentative valuable models, however, further work and elaboration is needed.

## **Appendices**

### **Appendix A      Participants' Demographic Information**

The following tables are drawn from the NVivo data base are related to a questionnaire in Appendix A.1

NO.	Participants (Abbreviated names)	Current Educational Level of Study in the UK	PhD Year of Study	Current Field of Study in the UK	Discipline of Bachelor Degree	Bachelor Graduation Date	Period of Being in the UK	Age
1	AFA	PhD	Third Year	Psychology	Psychology	Before 2000	Unassigned	More than 30
2	AFR	PhD	Third Year	Physiotherapy	Physiotherapy	2006-2012	5 years	20-25
3	ALA	PhD	Second Year	Computer Science	Computer Science	2006-2012	3 years	26-30
4	AML	MSc	N/A	Information System Management	Information System Management	2006-2012	1 year	20-25
5	ARE	PhD	Third Year	Computer Science	Computer Science	2001-2005	4 years	More than 30
6	BDR	PhD	Third Year	Unassigned	Home Economics and Arts	2001-2005	4 years	More than 30
7	DAL	PhD	Second Year	Computer Science	Computer Science	2006-2012	3 years	26-30
8	EMA	PhD	Third Year	Computer Science	Computer Science	2006-2012	4 years	26-30
9	FAT	PhD	Second Year	Computer Science	Computer Science	2001-2005	3 years	More than 30
10	GAD	PhD	Second Year	Psychology	Psychology	2001-2005	3 years	More than 30
11	HEN	PhD	Second Year	Engineering	Physics	2001-2005	4 years	More than 30
12	LAM	MSc	N/A	Psychology	Psychology	2006-2012	1 year	26-30
13	LAY	PhD	Third Year	Finance	Business	2001-2005	4 years	More than 30
14	MAH	MBA	N/A	Education Management and Leadership	Education	2001-2005	1 year	26-30
15	MAJ	PhD	Second Year	Accounting	Accounting	2006-2012	3 years	26-30
16	REE	MSc	N/A	Health Science	Applied Medical Science/Rehabilitation	2001-2005	1 year	More than 30
17	REM	IPhD	Second Year	Modern Languages, ELT	English Language Literature	2001-2005	2 years	More than 30

<b>18</b>	RSH	PhD	Second Year	Management	English Literature	2006-2012	3 years	26-30
<b>19</b>	SAJ	MSc	N/A	Health Science	Applied Medical Science/Respiratory Care	2006-2012	1 year	20-25
<b>20</b>	SAR	PhD	Third Year	Computer Science	Computer Science	2006-2012	5 years	26-30

Table 11: Participants' academic educational status

<b>NO.</b>	<b>Participants (Abbreviated names)</b>	<b>Starting date of studying English language</b>	<b>Attend English Language Course in Saudi Arabia</b>	<b>English Language Course in the UK</b>	<b>Level of Proficiency in Reading English before Arriving in the UK</b>	<b>Level of Proficiency in Writing English before Arriving in the UK</b>	<b>English Language Course in the UK</b>	<b>Period of the Programme</b>	<b>Date of the Programme</b>	<b>Overall Score in the Programme</b>	<b>Writing Score in the Programme</b>	<b>Reading Score in the Programme</b>
<b>1</b>	AFA	Secondary school	Yes	Yes	Poor	Poor	Yes	7-9 months	2007	6.5	6.0	6.0
<b>2</b>	AFR	Primary school	Yes	Yes	Poor	Very poor	Yes	1-3 months	2009	7.0	6.0	6.5
<b>3</b>	ALA	Primary school	No	Yes	Good	Moderate	Yes	7-9 months	2009	6.5	6.0	6.0
<b>4</b>	AML	Intermediate school	Yes	Yes	Moderate	Moderate	Yes	7-9 months	Unassigned	6.5	6.5	6.5
<b>5</b>	ARE	Primary school	No	Yes	Moderate	Moderate	Yes	1-3 months	2010	7.0	6.5	6.5
<b>6</b>	BDR	Intermediate school	Yes	Yes	Moderate	Moderate	Yes	1-3 months	2008	6.5	6.0	6.5
<b>7</b>	DAL	Primary school	Yes	Yes	Moderate	Good	Yes	7-9 months	2010	6.5	6.0	6.5
<b>8</b>	EMA	Intermediate school	Yes	Yes	Moderate	Poor	Yes	4-6 months	2008	6.5	6.5	6.0

NO.	Participants (Abbreviated names)	Starting date of studying English language	Attend English Language Course in Saudi Arabia	English Language Course in the UK	Level of Proficiency in Reading English before Arriving in the UK	Level of Proficiency in Writing English before Arriving in the UK	English Language Course in the UK	Period of the Programme	Date of the Programme	Overall Score in the Programme	Writing Score in the Programme	Reading Score in the Programme
9	FAT	Intermediate school	Yes	Yes	Good	Good	Yes	4-6 months	2008	7.0	6.5	6.5
10	GAD	Secondary school	Yes	Yes	Moderate	Moderate	Yes	7-9 months	2008	6.5	6.5	6.0
11	HEN	Intermediate school	Yes	Yes	Moderate	Moderate	Yes	7-9 months	2009	6.5	6.5	6.0
12	LAM	Primary school	No	Yes	Poor	Poor	Yes	4-6 months	2012	6.5	6.5	6.5
13	LAY	Primary school	Yes	Yes	Moderate	Poor	Yes	10-12 months	2009	6.5	5.5	6.0
14	MAH	Intermediate school	Yes	Yes	Poor	Very poor	Yes	10-12 months	Unassigned	6.5	6.5	6.5
15	MAJ	Intermediate school	Yes	Yes	Poor	Poor	Yes	4-6 months	2010	6.5	6.0	6.5
16	REE	Intermediate school	No	Yes	Moderate	Moderate	Yes	1-3 months	Unassigned	7.0	6.5	6.5
17	REM	Intermediate school	Yes	Yes	Moderate	Moderate	Yes	1-3 months	2009	Not Applicable	Not Applicable	Not Applicable
18	RSH	Intermediate school	No	Yes	Moderate	Moderate	Yes	1-3 months	2010	7.0	6.5	6.5
19	SAJ	Intermediate school	No	Yes	Moderate	Moderate	Yes	4-6 months	2012	7.0	6.5	6.5
20	SAR	Primary school	Yes	Yes	Moderate	Poor	Yes	7-9 months	2009	6.5	6.0	6.5

Table 12: Participants' English Language proficiency level

NO.	Participants (Abbreviated names)	Official English Test	The Name of the Last English Test	Date of the English Test	Overall Score	Writing Score	Reading Score	Level of English Proficiency in the Present day in the UK	Level of Proficiency when Reading English in the Present day in the UK	Level of Proficiency when Writing English in the Present day in the UK
1	AFA	Yes	IELTS	2007	5.5	4.5	5.0	Upper-intermediate	Good	Good
2	AFR	Yes	IELTS	2009	6.0	5.0	5.0	Upper-intermediate	Moderate	Moderate
3	ALA	Yes	IELTS	2010	6.5	6.0	6.5	Upper-intermediate	Very good	Very good
4	AML	Yes	IELTS	N/A	5.5	6.0	5.0	Upper-intermediate	Good	Very good
5	ARE	Yes	IELTS	2010	6.5	6.0	6.0	Upper-intermediate	Very good	Very good
6	BDR	Yes	IELTS	2007	6.0	5.5	5.5	Upper-intermediate	Good	Good
7	DAL	Yes	IELTS	2010	6.0	5.0	5.5	Intermediate	Very good	Very good
8	EMA	Yes	IELTS	2008	6.0	5.0	5.5	Intermediate	Good	Moderate
9	FAT	Yes	IELTS	2007	6.5	6.0	6.5	Upper-intermediate	Very good	Very good
10	GAD	Yes	IELTS	2007	5.0	4.5	4.5	Upper-intermediate	Good	Moderate
11	HEN	Yes	IELTS	2009	5.5	5.0	5.0	Upper-intermediate	Good	Good
12	LAM	Yes	IELTS	2012	6.5	6.5	6.5	Intermediate	Good	Moderate
13	LAY	Yes	IELTS	2009	5.5	4.5	5.0	Upper-intermediate	Good	Good
14	MAH	Yes	IELTS	2010	5.5	5.5	5.0	Intermediate	Good	Good
15	MAJ	Yes	IELTS	2010	6.0	5.5	5.5	Upper-intermediate	Very good	Good
16	REE	Yes	IELTS	N/A	5.0	5.0	4.5	Intermediate	Good	Good
17	REM	Yes	IELTS	2010	7.0	6.5	6.0	Upper-intermediate	Very good	Very good
18	RSH	Yes	IELTS	2010	6.0	5.5	5.5	Upper-intermediate	Very good	Moderate
19	SAJ	Yes	IELTS	2012	6.0	6.0	5.0	Upper-intermediate	Moderate	Good
20	SAR	Yes	IELTS	2009	6.5	6.0	6.0	Advanced	Very good	Very good

Table 13: Participants' English language proficiency test scores

NO.	Participants (Abbreviated names)	Starting Date to Receive education in Basic Digital Skills	Starting Date to Read Digitally	Starting Date to Write Digitally	Academic Reading Training in Saudi Arabia	Digital Academic Reading Training in Saudi Arabia	Digital Academic Reading Training in the UK
1	AFA	University	Master's degree	Bachelor's degree	No	No	No
2	AFR	University	Master's degree	Bachelor's degree	No	No	No
3	ALA	University	Master's degree	Bachelor's degree	No	No	No
4	AML	University	Master's degree	Bachelor's degree	No	No	No
5	ARE	University	Master's degree	Bachelor's degree	No	No	No
6	BDR	University	Master's degree	Bachelor's degree	No	No	No
7	DAL	University	Master's degree	Bachelor's degree	No	No	No
8	EMA	University	Master's degree	Bachelor's degree	No	No	No
9	FAT	University	Bachelor's degree	Bachelor's degree	No	No	No
10	GAD	University	Master's degree	Bachelor's degree	No	No	No
11	HEN	University	Master's degree	Bachelor's degree	No	No	No
12	LAM	University	Master's degree	Bachelor's degree	No	No	No
13	LAY	University	PhD	Bachelor's degree	No	No	No
14	MAH	University	Master's degree	Bachelor's degree	No	No	No
15	MAJ	University	Master's degree	Bachelor's degree	No	No	No
16	REE	University	Master's degree	Bachelor's degree	No	No	No
17	REM	University	Master's degree	Bachelor's degree	No	No	No
18	RSH	University	Master's degree	Bachelor's degree	No	No	No
19	SAJ	University	Master's degree	Bachelor's degree	No	No	No
20	SAR	University	Master's degree	Bachelor's degree	No	No	No

Table 14: Participants' digital literacy education

NO.	Participants (Abbreviated names)	Comfortable with Using Screens for Reading	Comfortable with Using a Computer	Comfortable Digital Writing	Experience in Using Computers	Frequency of Reading Digital Academic Materials During Bachelor	Frequency of Reading Digital Academic Materials in the UK at the Present	Attitude towards Proficiently to Read Academic Text	Attitude towards proficiently to Read Digital Academic Text
1	AFA	Not comfortable	Comfortable	Comfortable	Low	Never	Often	Very important	Important
2	AFR	Comfortable	Very comfortable	Very Comfortable	High	Never	Often	Very important	Very important
3	ALA	Comfortable	Very comfortable	Very Comfortable	High	Never	Often	Very important	Important
4	AML	Not comfortable	Comfortable	Comfortable	Low	Rarely	Sometimes	Very important	Not important
5	ARE	Comfortable	Very comfortable	Very Comfortable	High	Rarely	Often	Very important	Important
6	BDR	Comfortable	Comfortable	Comfortable	Low	Never	Often	Very important	Very important
7	DAL	Comfortable	Very comfortable	Very Comfortable	High	Rarely	Often	Very important	Very important
8	EMA	Very comfortable	Very comfortable	Very Comfortable	High	Never	Often	Very important	Very important
9	FAT	Comfortable	Very comfortable	Very Comfortable	High	Rarely	Often	Very important	Very important
10	GAD	Not comfortable	Comfortable	Comfortable	Low	Never	Sometimes	Very important	Important
11	HEN	Not comfortable	Comfortable	Comfortable	Low	Never	Often	Very important	Important
12	LAM	Not comfortable	Comfortable	Comfortable	Low	Never	Rarely	Important	Not so important
13	LAY	Comfortable	Comfortable	Comfortable	Low	Never	Often	Very important	Important

NO.	Participants (Abbreviated names)	Comfortable with Using Screens for Reading	Comfortable with Using a Computer	Comfortable Digital Writing	Experience in Using Computers	Frequency of Reading Digital Academic Materials During Bachelor	Frequency of Reading Digital Academic Materials in the UK at the Present	Attitude towards Proficiently to Read Academic Text	Attitude towards proficiently to Read Digital Academic Text
14	MAH	Not comfortable	Comfortable	Comfortable	Low	Never	Rarely	Important	Not so important
15	MAJ	Comfortable	Comfortable	Very Comfortable	Low	Never	Often	Very important	Important
16	REE	Not comfortable	Comfortable	Comfortable	Low	Rarely	Sometimes	Very important	Not important
17	REM	Not comfortable	Comfortable	Very Comfortable	Low	Rarely	Often	Very important	Important
18	RSH	Comfortable	Very comfortable	Very Comfortable	Low	Rarely	Always	Very important	Important
19	SAJ	Not comfortable	Comfortable	Comfortable	Low	Rarely	Sometimes	Important	Not so important
20	SAR	Very comfortable	Very comfortable	Very Comfortable	High	Never	Always	Very important	Very important

Table 15: Participants' on-screen reading perceptions and practices

## A.1 Students' Demographic Questionnaire

Name:

Please answer the following questions:

1. How old are you?
  - a. 20-25
  - b. 26-30
  - c. More than 30
  
2. When did you start studying the English language in the educational system of your home country?
  - a. Kindergarten
  - b. Primary school
  - c. Intermediate school
  - d. Secondary school
  - e. University
  - f. After university
  
3. What was the discipline of your Bachelor's degree?  
.....
  
4. Would you please specify the name of the University?  
.....
  
5. When did you graduate?
  - a. Before 2000
  - b. 2001-2005
  - c. 2006-2012
  
6. What language did you use for your Bachelor's degree study?
  - a. Arabic materials and Arabic instruction
  - b. English material and English instruction
  - c. English materials and Arabic instruction
  - d. English materials; and Arabic and English Instruction
  - e. English and Arabic materials; and English instruction

- f. English and Arabic materials; and Arabic instruction
  - g. English and Arabic materials; and English and Arabic instruction
7. When did you start receiving education in basic digital skills in the Saudi educational system?
- a. Kindergarten
  - b. Primary school
  - c. Intermediate school
  - d. Secondary school
  - e. University
  - f. After university

8. When did you start to read digitally?
- a. Kindergarten
  - b. Primary school
  - c. Intermediate school
  - d. Secondary school
  - e. Bachelor's degree
  - f. Master's degree
  - g. PhD

9. When did you start to write digitally?
- a. Kindergarten
  - b. Primary school
  - c. Intermediate school
  - d. Secondary school
  - e. Bachelor's degree
  - f. Master's degree
  - g. PhD

10. Did you undertake any kind of training about academic reading in Saudi Arabia **BEFORE** coming to study in the UK?
- a. Yes
  - b. No

If yes (please specify).....

11. Did you undertake any kind of training about academic digital reading and strategies to read online in Saudi Arabia **BEFORE** coming to study in the UK?
- a. Yes
  - b. No

If yes (please specify).....

12. Please estimate your frequency of reading digital academic materials **BEFORE** you arrived in the UK.
- a. Never
  - b. Rarely
  - c. Sometimes
  - d. Often
  - e. Always

13. Please estimate your frequency of reading digital academic materials in the UK at the present time.
- a. Never
  - b. Rarely
  - c. Sometimes
  - d. Often
  - e. Always

14. Did you attend any English language course in Saudi Arabia **BEFORE** coming to study in the UK?
- a. Yes
  - b. No.....

15. Please estimate your level of English proficiency **BEFORE** you arrived in the UK?
- a. Elementary .....
  - b. Pre-intermediate
  - c. Intermediate.....
  - d. Upper-intermediate
  - e. Advanced

If other (Please specify) .....

16. Please estimate your proficiency level in reading English **BEFORE** you arrived in the UK?

- a. Very poor
- b. Poor
- c. Moderate
- d. Good
- e. Very good
- f. Excellent

17. Please estimate your proficiency level in writing English **BEFORE** you arrived in the UK?

- a. Very poor
- b. Poor
- c. Moderate
- d. Good
- e. Very good
- f. Excellent

18. Did you take any kind of official English test?

- a. Yes
- b. No

19. If yes please indicate the name of the last English test that you undertook?

- a. IELTS
- b. TOEFL
- c. Other (please specify) .....

Please specify the date in which you undertook the test.

.....

What was your overall score? .....

What was your reading score? .....

What was your writing score? .....

20. Have you ever undertaken any kind of language course in the UK?

- a. Yes
- b. No

If yes, which programme did you undertake?

- a. General English
- b. English for academic study
- c. General English and English for academic study
- d. Preparation for official English test programme e.g. IELTS or TOEFL
- e. Other (please specify).....

Please specify the date when you undertook this.

.....

Please specify for how long?

- a. 1-3 months
- b. 4-6 months
- c. 7-9 months
- d. 10-12 months
- e. More than 12 months

What was your overall score? .....

What was your reading score? .....

What was your writing score? .....

21. Please estimate your present day level of English proficiency in the UK.

- a. Elementary
- b. Pre-intermediate
- c. Intermediate
- d. Upper-intermediate
- e. Advanced
- f. Other (Please specify) .....

22. Please estimate your present level of proficiency when reading English.

- a. Very poor
- b. Poor
- c. Moderate
- d. Good
- e. Very good
- f. Excellent

23. Please estimate your present level of proficiency when writing English.

- a. Very poor
- b. Poor
- c. Moderate
- d. Good
- e. Very good
- f. Excellent

24. How important is it for you to proficiently read English academic text?

- a. Very important
- b. Important
- c. Not so important
- d. Not important

25. How important is it for you to proficiently read digital English academic text?

- a. very important
- b. important
- c. not so important
- d. not important

26. How long have you been in the UK?

.....

27. What is your current educational stage in the UK?

- a. MA
- b. MSc
- c. MBA
- d. I PhD
- e. PhD.....

Other (please specify).....

28. If you are a PhD or IPhD student, what year are you in now?

.....

29. From where did you obtain your Master's degree?

- a. Saudi Arabia
- b. The UK
- c. Other (please specify) .....

30. What is your current field of study in the UK?

.....

How do you categorize your experience in using computers?

- a. High experience
- b. No experience
- c. Low experience

31. How comfortable are you with using a computer?

- a. Very comfortable
- b. Comfortable
- c. Not at all comfortable

32. How comfortable are you with using a computer to write?

- a. Very comfortable
- b. Comfortable
- c. Not at all comfortable

33. How comfortable are you with using a computer to read academic materials for studying purposes?

- a. Very comfortable
- b. Comfortable
- c. Not at all comfortable

**Thankyou**

## Appendix B Text Selection Criteria

As you are going to read an academic research article in your field of study just as you would do for your study in real time, the following criteria should be considered in the two articles that you select to bring to the session. The two articles should be different but specific to your subject area and on the same topic. Each article should be:

1. More than 5 pages
2. Used technical language and specialized vocabulary
3. Include bibliography or/and list of references
4. Accompanied by tables, charts, pictures and/or figures
5. Include main title and subtitles
6. Include the authors' names, the name of the journal, issue and volume numbers and date of publication
7. Structured into abstract, introduction, review of a literature, methodology, results, discussion and conclusion

### NOTE:

Please bring one of the articles printed on A4 paper and have the other one saved in your Cloud, on a USB or in your email.

## Appendix C Interview Questions

### C.1 Master's-Phase 1 and PhD Students Interview Questions

The purpose of this interview is to collect information about participants' previous reading practices when studying for their bachelor's degree in their home country (Saudi Arabia), their L2 academic reading course in the UK, and their current L2 academic reading when reading L2 research articles in their field of study during their PhD program.

Q1. Would you please discuss how you learned your Arabic and English reading skills in your home country? How do you evaluate your experience and your reading skill knowledge?

Q2. Would you please discuss your previous academic reading practice when studying for your bachelor's degree in Saudi Arabia? (Printed and digital)?

Would you please discuss your reading experience in the academic libraries during your stages of study in Saudi Arabia?

What sources of materials did you read? Were they printed or online? What did you prefer and why?

What did you understand better, reading online or hard copies? Why was this?

What kinds of material did you read? Were they books, teachers' hand-outs or research articles?

Which materials did you read the most and the least, and what was the reason for this?

What about reading research articles? How often did you read these and why?

What was the purpose of your academic reading? Was it for writing assignments, taking exams, learning, or participating in lectures? Which purpose was used the most and the least? What kinds of material were you reading for each purpose and why? How often were you reading each material for each purpose? Were you only reading before the deadline of your specified purpose or regularly during your course? If so why was this? Were you reading lots of materials to achieve your academic purpose or only for your specified course documents? Please explain why this was the case. What were the steps that you followed when you read for each purpose? Please explain this in greater detail. Were digital services that supported your digital reading available in your home country? How did these affect your reading? Were you practicing any form of online social reading? Were you reading with other colleagues? If so how often and was this online/offline? Were you sharing comments with other colleagues? If so how often and was this online/offline? Which sources (affordances) did you use when you read print and online documents (e.g. a dictionary, a pen and notebook, a PC, other articles etc.)? Do you have anything else that you would like to add about your previous reading practices when studying for your bachelor's degree?

Q3. Would you please discuss your previous academic L2 reading course which you undertook prior to starting your postgraduate study? What have you learned about reading in the academic course? What kinds of material were you reading in and outside of the classroom (e.g. text from the course book, and/or academic/general research articles)? What source of materials were you reading, online or offline? Were you reading in groups in the classroom, outside of class; and online or offline? If so please explain further. Have you been taught to read online? If so please explain further. Have you practiced reading online in the classroom/outside of the classroom? Did your teacher encourage you to read extra materials online or offline outside of the classroom? Did you read printed or online research articles in the classroom/outside of the classroom? Have you been introduced to the information structure and organisation of research articles? Which sources (affordances) did you use when you read print and online documents (e.g. a dictionary, a pen and notebook, a PC, other articles etc.)? Did your reading tutors introduce you to technological reading affordances and did they encourage you to use some of them during reading? With regards to your essays and final assignment, how did you prepare for these? Please explain further. How do you evaluate your English reading course in terms of its effectiveness, learning something new such as reading strategies and ways of reading, etc.? Please explain. What do you think the academic English reading course added to your academic reading skill? What did you need from this course regarding your reading skill? Do you have anything that you would like to add about your previous academic English reading course? Let us now move on to your current academic reading in your field of study within the UK context.

Q4. Would you please discuss your current L2 academic reading practices in the UK? (Printed and digital)? What kinds of material did you read the most and least (e.g. research article, reports, and textbooks)? Why was this?

What source of materials did you read the most and least (e.g. online and/or printed)? Why was this and which did you prefer?

What was the main and least purpose for what you read?

Did you read differently when you read for each purpose?

How much reading do you do now on a daily basis? At the beginning of your time in the UK do you feel that you read more or less when compared with the time when you studied for your bachelor's degree?

Would you please discuss your use of the following reading strategies? How did you use them and for what purpose?

What do you know about critical reading? How and when do you apply this and how did you learn this? Please explain.

Q5. Can you discuss your use of technology for academic reading?

When did you start using technology to study and particularly to read in the academic field?

Which digital sources (affordances) do you use when you read print and online documents (e.g. an electronic dictionary, YouTube, a pen and notebook, a PC, other articles, other references, words, Excel, an iPad, an iPhone, reference programs, blogs, wikis, Endnote, reference manager and Mendeley, etc.)?

What do you think about digital reading, digital reading affordances, and gaining assistance from digital textual resources? Do you find them helpful, not helpful, or don't you know?

Has the availability of digital services in the UK academic context affected your academic print and digital reading? Why is this?

Q6. Would you please discuss the reading challenges which you encountered when reading a research article in your own field of study at the beginning of your academic study in the UK? (E.g. reading strategies, content knowledge, linguistic knowledge, text organisation) whether (printed and digital)?

How did you overcome these challenges?

What are the reading challenges that you are currently encountering during your academic L2 reading of research articles?

How do you try to overcome these challenges?

Was the reading of research articles at the beginning challenging for you? Why was this? What about now? Please explain.

How do you read a research article associated with your own field of study?

What are the important parts that you look for and focus on, when reading a research paper?

Q7. Would you please provide me with an overview of what the changes have been that have occurred to your L2 reading of research articles practice and performance since you started your postgraduate programme in the UK until now, (printed and digital)? (e.g. reading comprehension, reading fluency, amount of reading and reading strategies)?

Q8. Would you please discuss the factors that have positively affected your academic L2 reading during your postgraduate study in the UK, (printed and digital)? (e.g. personal factors, social factors, and academic factors)?

What kind of social activities which you are involved in the UK affect your academic reading?

What are the roles of society and culture in changing your reading style?

What is the role of the educational context in changing your academic reading practices?

What is the role of your previous reading education in affecting your current academic reading?

Does your inner speech occur in Arabic or English when you read English academic materials?

Why is this?

What are the academic reading expectations of your tutors in Saudi Arabia and the UK (printed and digital)? How do you think this affects your previous and current academic reading?

What is the difference between your academic reading in Saudi Arabia and the UK?

Thank you for your participation. If you require future help regarding your L2 academic reading please do not hesitate to contact me.

## C.2 Master's-Phase 2 Students Interview Questions

The purpose of this interview is to collect information about the Master participants' L2 academic reading practices that took place during the mid of their Master programme in the UK.

Q.1 Would you please discuss your current L2 academic reading practices in the UK? (Printed and digital)?

Q.1a What kinds of material did you read the most and least (e.g. research article, reports, and textbooks)? Why was this?

Q.1b What source of materials did you read the most and least (e.g. online and/or printed)? Why was this and which did you prefer?

Q.1c What was the main and least purpose for what you read?

Q.1d Did you read differently when you read for each purpose?

Q.1e How much reading do you do now on a daily basis? At the beginning of your time in the UK do you feel that you read more or less when compared with the time when you studied for your bachelor's degree?

Q.1f Would you please discuss your use of the following reading strategies? How did you use them and for what purpose?

Q.1g What do you know about critical reading? How and when do you apply this and how did you learn this? Please explain.

Q.2 Can you discuss your use of technology for academic reading?

Q.2a Which digital sources (affordances) do you use when you read print and online documents (e.g. an electronic dictionary, YouTube, a pen and notebook, a PC, other articles, other references, words, Excel, an iPad, an iPhone, reference programs, blogs, wikis, Endnote, reference manager and Mendeley, etc.)?

Q.2b What do you think about digital reading, digital reading affordances, and gaining assistance from digital textual resources? Do you find them helpful, not helpful, or don't you know?

Q.2c Has the availability of digital services in the UK academic context affected your academic print and digital reading? Why is this?

Q.3 Would you please discuss the reading challenges which you encountered when reading a research article in your own field of study at the beginning of your academic study in the UK? (E.g. reading strategies, content knowledge, linguistic knowledge, text organisation) whether (printed and digital)?

Q.3a How did you overcome these challenges?

Q.3b What are the reading challenges that you still encounter during your academic L2 reading of research articles? Please explain.

Q.3c How do you try to overcome these challenges?

Q.3d Was the reading of research articles at the beginning challenging for you? Why was this? What about now? Please explain.

Q.3e How do you read a research article associated with your own field of study?

Q.3f What are the important parts that you look for and focus on, when reading a research paper?

Q.4 Would you please provide me with an overview of what the changes have been that have occurred to your L2 reading of research articles practice and performance since we last met until now (printed and digital)? (e.g. reading comprehension, reading fluency, amount of reading and reading strategies)?

Q.5 Would you please discuss the factors that have positively affected your academic L2 reading during your postgraduate study in the UK, (printed and digital)? (e.g. personal factors, social factors, and academic factors)?

Q.5a What kind of social activities which you are involved in the UK affect your academic reading?

Q.5b What are the roles of society and culture in changing your reading style?

Q.5c What is the role of the educational context in changing your academic reading practices?

Q.5d Does your inner speech occur in Arabic or English when you read English academic materials, Why is this?

Q.5e What is the difference between your academic reading in Saudi Arabia and the UK?

Thank you for your participation and if you need any sort of help regarding your L2 academic reading please contact me.

## Appendix D Consent Form

### CONSENT FORM (FACE TO FACE: 3966)

**Study title:** Academic Reading Practices

**Researcher name:** Hanadi Khadawardi

**Staff/Student number:** 23341025

**ERGO reference number:** 3966

Please read this information carefully before deciding whether to take part in this research. You will need to indicate that you have understood this information before you can continue. You must also be aged over 16 to participate. By ticking the box at the bottom of this page, you are indicating that you are aged over 16, and you are consenting to participate in this survey.

The study is to investigate how Saudi students read online academic materials and how their reading practices change over time while studying their Master and PhD degree in Britain.

If you accepted to participate in the study, you will be required to fill a demographic questionnaire. After that, you will be asked to read two different research articles that you chose from your field of study that you have not read before, printed and online for only twenty minutes each. During the reading process, you will be recorded and videotaped via a video camera and a software programme called Camtasia. You only need to read and verbalize your thoughts, followed by a session requires you to explain your recorded reading process. After that you will be interviewed for approximately to 60/90 minutes. During the interview, you will be asked about your L2 academic reading practices and the challenges that you experienced when you read academic paper. If you are a Master student, you will be observed and interviewed for two times during your one year Master study to follow your reading changes. If you are a PhD student, you will be observed and interviewed for only one time.

If participating in this study raises any issues for you, we recommend that you contact one of the following resources: [Chair of the Faculty Ethics Committee Prof Ros Mitchell (02380592231, [rjm3@soton.ac.uk](mailto:rjm3@soton.ac.uk))].

I have read and understood the information about this study. In consenting, I understand that my legal rights are not affected. I also understand that data collected as part of this research will be kept confidential and that published results will maintain that confidentiality. I finally understand that if I have any questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I may contact the Administrator of the Ethics Committee, Humanities, University of Southampton, SO17 1BJ, UK. Phone: +44 (0)23 8059 4663, Email: [I.Ghose@soton.ac.uk](mailto:I.Ghose@soton.ac.uk).

I certify that I am 16 years or older. I have read the above consent form and I give consent to participate in the above described research.

*Please initial the box(es) if you agree with the statement(s):*

I have read and understood the information sheet and have had the opportunity to ask questions about the study.

I agree to take part in this research project and agree for my data to be used for the purpose of this study

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected

#### Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.

Name of participant (print name).....

Signature of participant.....

Date.....

## Appendix E Invitation Letter

Dear student,

I am at present a postgraduate (PhD) Saudi student at the University of Southampton in Modern Languages/Applied Linguistics. I am conducting a research study to investigate how postgraduate students read online academic materials and how their reading practices change over time while studying their degree in the UK. I am looking for Saudi students to take part.

It is with great pleasure that I invite you to participate in this research study during your Master or PhD programme.

If you accepted to participate in the study, you will be required to fill a demographic questionnaire. After that, you will be asked to read for comprehension two different research articles that you chose from your field of study that you have not read before, printed and online for only twenty minutes each. During the reading process, you will be recorded and videotaped via a video camera and a software programme called Camtasia. You only need to read and verbalize your thoughts, followed by a session requires you to explain your recorded reading process. After that you will be interviewed for approximately to 60/90 minutes. During the interview, you will be asked about your L2 academic reading practices and the challenges that you experienced when you read academic paper. If you are a Master student, you will be observed and interviewed for three times during your one year Master study to follow your reading changes. If you are a PhD student, you will be observed and interviewed for only one time.

Your participation is important in helping me answer my research questions about the academic reading practices of postgraduate students and find out different and useful academic reading strategies for postgraduate students studying in the UK. Your participation is voluntary and you can at any time leave the project if you decide to do so. If you participate, your data and that of other participants will be stored and used on a secure system without your names being linked to it.

If you are willing to participate in this research, if you have any questions about this letter or your right as a participant, or you have enquiries regarding your own L2 academic reading, would you please contact me on this e-mail ([hak1g10@soton.ac.uk](mailto:hak1g10@soton.ac.uk))

I look forward to working with you to help me reach my professional goals.

Many thanks in advance for your time and efforts.

Hanadi Khadawardi / PhD Candidate/University of Southampton

## Appendix F Directions for Think-Aloud Session

You are going to read your research article for comprehending information. Read the text just as you would do for your study in real time. Any time you think something, say it out-loud. It can be something you think about the article you are reading or it can be something about the process you use to read and understand. Do not worry if you forget to think-aloud; if that happens, we will discuss and talk about what was running through your mind later. All you have to do is to read your article and tell me what you are thinking and doing. We will spend about 20 minutes doing this activity. You are going to read this article plus you are free to read whatever you need during these 20 minutes, as if you are reading for your study. I am going to turn on the video camera. I will stay behind taking my notes while you are talking. If you have any questions at any time, just stop and ask me.

Okay? Do you have any question?

أنتِ الآن سوف تقرأي المقالة العلمية الخاصة بك لفهم المعلومات. أطلب منك ان تقرأ أي النص تماما كما تفعلي لدراستك في الوقت الحقيقي. عندما تفكري في اي امر متعلق بالنص أرجو منك ان تنطقي بجميع افكارك بصوت مسموع . يمكن أن يكون شيئا خاص بالمعلومات الموجوده في مقاله التي تقرأها أو أنه يمكن أن يكون شيئا عن العملية التي تستخدمها لقراءة وفهم النص . لا تقلق إذا كنتِ قد نسيت التعبير عن أفكارك بصوت مسموع في وقت ما؛ إذا حدث ذلك ، سوف نناقش و نتحدث عن ما تم خلال القراءة في وقت لاحق . كل ما عليك القيام به الان هو قراءة مقالك وقول ما كنتِ تفكر و تقوم به لفهم المقالة. سوف نستغرق حوالي عشرون دقيقة للقيام بهذا النشاط. أنتِ حره في قراءة كل ما تحتاجينه خلال هذه العشرون دقيقة كما لو كنتِ تقرأ لدراستك . انا سوف أقوم بتشغيل كاميرا الفيديو وسأبقى في الخلف. سوف اقوم بكتابة ملاحظات وأنتِ تقرأ أي . إذا كان لديك أي أسئلة في أي وقت، فقط توقف و أسألي.

حسنا؟ هل لديك اي سؤال؟

## Appendix G Directions for Stimulated Recall Session

What we are going to do now is watch the video. I am interested in what you were thinking and doing at the time you were reading. We can see what you were doing by looking at the video, but I don't know what you were thinking or doing in some instances. So, what I would like you to do is tell me what you were thinking, what you were doing, what was in your mind at the time while you were reading. I am going to pause the video at specific instances, and ask you to tell me what you were doing or thinking or why you did specific action.

Okay? Do you have any question?

ما نحن الان بصدد القيام به هو مشاهدة الفيديو. أنا مهته في ما كنت تفكرين فيه وتقومين به في الوقت الذي كنتِ تقرأين فيه المقالة. سوف نتعرف على ما كنتِ تفعلينه وقت القراءة من خلال مشاهدة هذا الفيديو، ولكن انا لا أعرف جميع ما كنتِ تفكر به أو في بعض الحالات وقت قراءتك للمقالة. لذلك ، ما أود منك أن تفعليه هو أن تقول

لي ما كنت تفكر به وماذا كنت تفعلين لفهم النص. وانا سوف اقوم بأيقاف الفيديو لبرهة في بعض الدقائق وأطلب منك أن تقومي بشرح ما كنت تفعلينه أو تفكرين به وقت القراءة أو لماذا فعلت هذه أو تلك الإجراءات لفهم النص.

حسنًا؟ هل لديك اي سؤال؟

## Appendix H Training Text

From the comfort of our modern lives we tend to look back at the turn of the twentieth century as a dangerous time for sea travellers. With limited communication facilities, and shipping technology still in its infancy in the early nineteen hundreds, we consider ocean travel to have been a risky business. But to the people of the time it was one of the safest forms of transport. At the time of the Titanic's maiden voyage in 1912, there had only been four lives lost in the previous forty years on passenger ships on the North Atlantic crossing. And the Titanic was confidently proclaimed to be unsinkable. She represented the pinnacle of technological advance at the time. Her builders, crew and passengers had no doubt that she was the finest ship ever built. But still she did sink on April 14, 1912, taking 1,517 of her passengers and crew with her.

The Titanic left Southampton for New York on April 10, 1912. On board were some of the richest and most famous people of the time who had paid large sums of money to sail on the first voyage of the most luxurious ship in the world. Imagine her placed on her end: she was larger at 269 metres than many of the tallest buildings of the day. And with nine decks, she was as high as an eleven storey building. The Titanic carried 329 first class, 285 second class and 710 third class passengers with 899 crew members, under the care of the very experienced Captain Edward J. Smith. She also carried enough food to feed a small town, including 40,000 fresh eggs, 36,000 apples, 111,000 lbs of fresh meat and 2,200 lbs of coffee for the five day journey.

(Continued overleaf)

## Appendix I Descriptions of Sub-Strategies and Examples

Strategy function	Sub-strategies	Description	Examples
<b>Problem-solving (PROB): Mechanisms that enable readers to solve comprehension problems and overcome reading comprehension challenges.</b>	Changing reading rate	Readers slow their reading speed	'Here I was reading carefully (.) I tried to focus on these words'
	Re-reading	Readers re-read specific parts of the text	'Ahh this group of sentences (.) I could not understand them (.) I re-read them again'
	Using context	Readers solve comprehension problems by analysing sentences and attempting to use the sentences to comprehend specific ideas	'I was trying to understand the word consistently from the context. I was thinking, 'what does this word mean here?''
	Pausing	Readers stop reading for a period of time	'Okay, here I had to stop reading (.) I needed to think before I continued reading'
	Thinking	Readers mentally operate specific ideas in the text in order to comprehend them	'Then I asked myself why, then I tried to read to find the answer. Usually I do this and have a kind of dialogue with the articles. This helps me to understand and think. I think that's why I prefer to read in a quiet place, to be in a private place, not in public'
	Pointing	Readers use an object, such as a pen or pencil, or use the grooming finger or the cursor to point to specific sentences and/or words in order to return to a specific part of the text and finish reading	'I started to lose concentration and I was trying hard to focus and understand. The pen helps me to keep reading and focusing'
	Ignoring difficult sections	Readers ignore difficult parts of the text in order to continue reading	'Actually here I could not understand the idea (.) I re-read the sentences several times (.) also I re-read the whole paragraph from the beginning, but I could not understand what he wanted to say (.) actually I ignored it'
	Translating using hard copy dictionaries	Readers use traditional printed dictionaries to translate unfamiliar words	None

Strategy function	Sub-strategies	Description	Examples
<b>Problem-solving (PROB): Mechanisms that enable readers to solve comprehension problems and overcome reading comprehension challenges</b>	Translating electronically	Readers use electronic dictionaries or a dictionary website in order to translate unfamiliar words	<i>'Hmm, I cannot understand this sentence (00:23) I will see [she highlights the sentences, copies the sentence, opens Google translator, pasts the sentence] ° directly applicable studies° [she reads the meaning] it is still not clear'.</i>
	Separating text content	Readers draw lines to separate a sentence into different parts in order to understand long, complex sentences.	<i>'I tried to think about the different parts of this sentence (.) I could not understand it'</i>
	Connecting text content	Readers solve a comprehension problem in a specific part of a text by mentally connecting between sentences within one paragraph, between paragraphs and/or between paragraphs and graphs, diagrams and/or pictures.	<i>'I returned back to the table on the second page because here it describes the numbers (.) I needed to re-read the table (.) it was easier to get the information from the table'</i>

Strategy function	Sub-strategies	Description	Examples
<b>Support (SUP): Mechanisms that aid and foster readers' reading comprehension and enable readers to achieve a better understanding of the text.</b>	Marking the text	Readers use highlighters, pens or pencils to highlight the text and/or underline it. Readers use electronic highlighters to highlight when reading on-screen.	<i>'Okay, here they started the section with a question (.) I highlighted the question to focus on it and search for the answer to this question'</i>
	Summarising	Readers write a shortened form of sentences presenting specific parts of a text.	<i>'This information is very important, I may use it in my assignments (.) I wrote summary of it so I can remember the information and return back to this article'</i>
	Taking notes	Readers either use a hard copy notebook to write notes about specific parts of a text, or use software or a Word document to type	<i>'Also, here I had to write important information about the duration of the eight weeks' training'</i>

Strategy function	Sub-strategies	Description	Examples
<b>Support (SUP): Mechanisms that aid and foster readers' reading comprehension and enable readers to achieve a better understanding of the text.</b>		out key information about specific parts of a text.	
	Reading aloud	Readers vocalise specific parts of a text when reading in order to support their comprehension	<i>'If I feel the sentence is useful and related to my project (.) I re-read it aloud, highlight it and return to my writing to look for where it fits in, and then paraphrase it'</i>
	Vocalising electronically	Readers use specific software or Google voice to have specific words, sentences and/or paragraphs read aloud electronically	<i>'It was hard for me to pronounce it as well. I used Google to get the meaning of the word and listen to its pronunciation'</i>
	Formulating questions	Readers support their comprehension by asking self-stimulating thinking questions about specific information included in a text	<i>'(00:12) okay when? These tests *** produced? *** [she writes notes]'</i>
	Paraphrasing	Readers write specific parts of a text in a Word document using their own words, and consider changing the sentence structure.	<i>'I wrote down these sentences here (.) ahh when I find useful sentences I paraphrase them immediately to save time'</i>
	Confirming	Readers utter specific words and/or phrases to confirm their understanding of specific information in a text when reading.	<i>'ahh okay **** okay and then [she moves the page down] **** all right **** so they took people who are elderly and from the community'</i>
	Connecting text content	Readers support their comprehension by connecting sentences within one paragraph, several paragraphs and/or between paragraphs and graphs, table and/or charts.	<i>'Actually, here I saw the diagram first and then I needed to re-read what was written before it (.) I knew that it was about another approach to information systems (.) ahh I did not read about it in detail, I only needed to know what it was (.) then I returned back to the diagram'</i>
	Pausing	Readers stop reading in order to comprehend unfamiliar information.	<i>'I highlighted here [she adjusts the screen] (01:35) [she scrolls the page down] (00:50) [she scrolls the page down] (00:44) [she scrolls the page down] (00:37) [she scrolls the page down] (00:12)'</i>
	Thinking	Readers spend time thinking about specific information written in a text.	<i>'Here I was trying to think about and arrange the information. I was thinking about the characteristics of <b>socially anxious people</b>. Ahh, I was explaining the information to myself in Arabic. This helps me to understand and remember the information'</i>

Strategy function	Sub-strategies	Description	Examples
	Reviewing	Readers go over the article, from the beginning to the end, to review the information included.	<i>'I returned to the beginning of the paragraph because I wanted to check my understanding of the main ideas in this paragraph'</i>
	Separating text content	Readers support their reading comprehension by mentally separating a specific paragraph into parts.	<i>'Okay (.) I highlighted the first part here to separate this from the rest of the paragraph (.) I wanted to focus on the numerical values first and then aah I completed the rest'</i>
	Pointing	Readers support their reading comprehension by using an object such as a pen or pencil; or using the grooming finger or the curser to point at specific sentences or/and word in order to track specific part of the text	<i>'&lt;I need the title of the paper or the link to return back to it [she scrolls the page up/ moves the cursor &gt; (00:04) [she highlights the title of the paper/ moves the cursor &gt;'</i> And SAJ/FN: <i>'She moves the cursor on the sentences while she is reading'</i>
	Continuing to read	Readers continually (keeping on) read the text without stopping.	<i>'Although here I could not understand several parts of the page I was reading (.), well I just wanted to get a general idea of everything'</i>
	Mentally visualising text content (mind-mapping within the text content)	Readers mentally visualise the text content to support their understanding.	<i>'I read this information and I was imagining the whole situation because of the style of the writer, where he used quotes of what he had said to patients (.) it is really exciting'</i>
	Using computer functions	Readers use different sorts of computer functions and facilities to support their reading comprehension.	<i>Here I used the side bar to go directly to the methods section'</i>

Strategy function	Sub-strategies	Description	Examples
<b>Global (GLOB): Mechanisms that enable readers to manage and monitor their reading process and use their previous experience to comprehend the text.</b>	Using visual aids	Readers study tables, graphs and charts in order to construct a general overview of a text.	<i>'They referred to a diagram and I moved the page down and here first I read the caption under the table, and then I read the table, all these numbers (.) After that I moved the page down and read this diagram'</i>
	Previewing	Readers review the text by going through sections to obtain a general idea of it.	<i>'This is my first reading of this paper (.) I am only checking the information and the different parts of the study (.) I don't read anything in detail (.) I only get the main idea of each part and then when I re-read those parts for the second time I focus on the details'</i>
	Locating key words	Readers identify the key words that represent the main ideas of a text	<i>'I was reading and I picking up the key words (.) For example 'empirical' (.) examines developing countries'</i>
	Identifying main ideas	Readers understand what the text is about by identifying the most important ideas in paragraphs.	<i>'Okay, here I wrote a note that there is only a difference in COP in the samples. Here I am writing down the main ideas only'</i>
	Attending selectively	Readers select specific parts of the text to read, instead of reading the text from the beginning to the end.	<i>'To save time (.) I don't have time to read everything in the paper (.) I need to be selective'</i>
	Skipping	Readers skip certain sentences, paragraphs or sections during continuous reading.	<i>'Okay, here I skipped the introduction because all of this is introductory information about the topic, I don't need to read this now because I have an idea of this topic'</i>
	Using background knowledge	Readers stimulate their previous knowledge and background information regarding the reading topic during the actual reading.	<i>'Here I was thinking about the goal, directed communication (.) actually I have read about this previously and I was thinking about that information and the connection between the sources (.) here they have presented it differently'</i>
	Anticipating	Readers expect and/or predict the content of a text by reading a title, headings, sub-headings and main ideas.	<i>'Ahh, here I read the title, ahh then (.) I stopped to think about its content and whether it relates to my assignment (.) then I started to read the first paragraph'</i>
	Planning	Readers initiate their reading of a text by formulating a plan for their reading.	<i>'Because this part here is a case study that I needed to include in my assignment (.) actually my reading now is just to select the relevant'</i>

Strategy function	Sub-strategies	Description	Examples
<b>Global (GLOB): Mechanisms that enable readers to manage and monitor their reading process and use their previous experience to comprehend the text</b>			<i>part, I mean, the parts that I might use in my assignment, and then I will re-read them again'</i>
	Having a purpose	Readers read with a purpose, For example, they may read to find a specific definition, to explore specific methods or to discover results.	<i>'I am searching for information about how Saudi students in Saudi Arabia use ecommerce (.) I found this paper about ecommerce in Saudi Arabia (.) In this paper I was looking for case studies on this topic, which I need to use in my assignment'</i>
	Mind mapping ideas (in relation to information from other resources)	Readers mentally visualise the content of the text in relation to other information from other resources	<i>'I was thinking and drawing connections between the methods that the author used in this paper and the methods that have been used in another research article (.) ahh, I was thinking about combining them together'</i>
	Scanning	Readers read a specific part of the text quickly to find precise information.	<i>'Okay, here I was reading this paragraph quickly because all these are details about the measurements (.) ahh (.) I am not focusing on this information at the moment (.) I only need to know the name of the measurements'</i>
	Pausing	Readers stop reading in order to think about and make connections between information within the text and their own background knowledge	<i>'I needed to stop here (.) ahh, I remember this (.) I have read about it in another source (.) ahh, it is about the relationship, ahh (.) yes (.) I needed to remember where I had read this'</i>
	Thinking	During reading, readers think about related information they have read in other sources.	<i>'Okay, here I was reading very slowly because I was trying to concentrate and think. I needed to understand these characteristics very well because they are related to my study (.) I am searching and focusing on this area'</i>
	Using text references	Readers use in text citations to refer back to the reference list in order to check and read relevant sources.	<i>'I found this citation (.) it is very relevant information to my topic (.) I needed to know the title of the paper (.) I searched for the article, downloaded it and saved it in one of the folders on my computer'</i>

Strategy function	Sub-strategies	Description	Examples
	Connecting ideas	Readers make connections between the information they are reading and information they have read previously.	<i>'Ahh, here I read the title, ahh then (.) I stopped to think about its content and whether it relates to my assignment (.) then I started to read the first paragraph'</i>

Strategy function	Sub-strategies	Description	Examples
<b>Critical (CRT): Mechanisms that enable readers to think critically about the content of the text and evaluate its validity.</b>	Evaluating the information	Readers evaluate the information in terms of its reliability and validity, for example, assessing the authors' justification for choosing a specific number of participants, or for using specific methods.	<i>'Actually, here I was thinking about their justification of this sample size (.) ahh, their justifications are quite good for why they chose this method and this period of time to conduct the study (.) they gave good justifications for all of these'</i>
	Evaluating the source of the information	Readers evaluate the source of information such as the author's reputation and date of publication.	<i>'Because it is from association European society (.) it is well known but actually when I checked the date I checked it is out dated 2001 it is old'</i>
	Evaluating the language	Readers evaluate the level of the English language of a text.	<i>The language of this paper is not too difficult, I could understand it easily but some of the papers I feel are really difficult, and I need to re-read the papers and translate a lot, but this was simple and understandable'</i>
	Evaluating the style	Readers evaluate the style of the text before or during reading the text in terms of its structure, the organisation of information and presentation.	<i>'This paper is clear and easy to read (.) ahh, the structure of the sentences is clear (.) I could follow the paper easily (.) but in that paper I noticed that the writers repeated information'</i>

Table 16: Descriptions of sub-strategies and examples

## Appendix J Sample data

### J.1 Transcription - Think-Aloud Sample

#### SAJ/Master/ Health Science/ Think-aloud protocol/Digital reading/First phase

° \*\*\*° the title is very presenting [she points with the cursor on the title] (00:30) ok here 2010 recent ok ° \*\*\*° the abstract (00:34) it says \*\*\* (00:15) means they already did what I want it is not written directly what is this two by two factorial design! (00:42) [She highlights words]I do research in Google [she opens a webpage, connect to the Internet, copy and paste the words in Google search space, click the first suggested result] (00:31)ok ° \*\*\*° (00:10) two by two factorial design is a kind of a method ° \*\*\*° (00:28) ok good [she returns to her reading article] [she highlights specific numbers][she moves the cursor on the sentences] (00:40) results [she moves the cursor roundly around specific number] ° \*\*\*° [she moves the cursor on the sentences][she highlight specific words and copies them] [she opens Google] research [she pasts the words in Google search] [ she opens Wikipedia] °\*\*\*° °° (00:10) [she moves the cursor on the sentences] ° \*\*\*° hum (00:30)[she returns to her previous article] ° \*\*\*° [ she moves the cursor] (00:37) it is very low less than one [ she moves the cursor on the sentences][she highlights specific words and copies them] (00:44) see what is confidence interval [she pasts the words in Google search][she opens new webpage] (00:12) confidence interval [she moves the cursor on the sentences][she closes the webpage and returns to her previous article] ° \*\*\*° [she moves the cursor on the sentences] ° \*\*\*° [she highlights specific words](00:10) [ she moves the cursor] ° \*\*\*° (00:35)this article is not relevant I do not think I need to complete reading it [she saved it and then closed it] [She opened her file and searched for specific articles and opened one] ° \*\*\*° (00:20) [she highlights a word in the title] [she moves the page down] ° Abstract\*\*\*° (00:14) [she moves the cursor on the sentences](she highlights specific words) [she moves the cursor on the sentences] ° \*\*\*° [she highlights specify word] [she opens Google translator and pastes the word]ok [she closes the page and returns to her reading article][she moves the cursor on the sentences] ° \*\*\*° (00:13) [she highlights specific sentences and moves the page down] °\*\*\*° °° [she moves the cursory on the sentences] ° \*\*\*° [she moves the page down] ° \*\*\*° [she highlights specific sentences][she moves the cursor on the sentences] ° \*\*\*° [she moves the page up][she moves the cursor on the sentences][she moves the page down] [ she moves the cursor on the page] [she moves the page up and moves it down] (02:12) [she writes memo on her

I phone][she moves the cursor on the sentences] [she highlights the numbers][she moves the cursor carelessly on the sentences] ° \*\*\*\*° [she moves the cursor on the sentences][she highlights numbers](00:40) ° \*\*\*\*° [she closes a warning box of battery low] [she moves the cursor on the sentences and moves the page down]the conclusion [she moves the cursor on the sentences] ° \*\*\*\*° ahh 47 and 104 (00:46) [she circles the numbers by the cursor] (00:22)ok [she moves the cursor on the sentences and moves the page down]hum[she moves the page up] \*\*\* feasibility trial [she highlights specific words] [she opens new webpage and pasts the words in Google search][she returns back to the search webpage and opens the second suggested option][ she moves the page down] hum this is another article [she closes the article and returns to the search page] [she adds the word means and click enter][she opens a new webpage] (00:50) [she returns back to her previous research article] in which year! (00:25) 2004 hum that is why they conducted another study after it [she returns to her folder and opens previous article] this is 2010 [she closes it and renames it including the date]

### **LAY/ PhD/ Think-aloud session/ Digital reading**

I chose this article because I want to talk about the stock market ahh in the GCC region (.) In general I want to see information about it therefore I downloaded this paper ahh first of all I read the abstract and the aim of this ahh paper ahh (.) It talks about the oil I don't want oil but I want to read about the stock market in general [she scrolls the page down] Ahh It is important for me to know its data 2011 or 2012 it is very new updated so this is the information that I want to reach [She scrolls the page down] ahh I will not read the introduction now because it talks about the oil and it is not important for me to talk about oil because it is not my field it talks about oil prices and stock market so I don't want this not this what I want [she keeps scrolling the pages down] here is the back ground [she points with her finger] this is the most important part for me [she points with the finger] I highlight the title because that is what I want to read and I want to find It is important for me also to ahh (.) say ahh I want to take something ok (.) I open word usually (.) I write in my document that I add to it every time [she opens a Word document/returns to the article/ highlights specific sentences] I cut and paste and take it in into the writing because I want this information in this way and this sentence in this way so I take it and I want to write this sentence in this way so I take it ahh (.) [She opens the reading article/reads/highlights] this information is important for me and it is important to include this reference (.) I copy and paste and then I go here [she opens the Word document] ok and save it is (.) ahh this should be linked to my endnote so after I copy and paste I make it italic (.) I do usually italic when I take the information as it is because I don't want the pilgrims so I remember to ahh paraphrase it and it is related to the end note so I can know from where I got it (.) [she opens the reading article] all

these references could be important but I revise it at the end and highlight them to return to them later on (.) [She reads] ok all this I don't care about because it is about oil I don't want to read about oil and not care about it (.) I highlight all this and write notes all this background and when it starts (00:21) here also there is an information talks about market value of the (.) ahh the market value of the GCC in general so I take all of this (.) very important for me this information [she points with her finger/ re-reads with moving the cursor on the line/she highlight/ (00:21) copies/ opens the Word document/ paste it in the word/ she writes heading BACKGROUND in the Word document/makes it bold/ reads and highlights the sentences/makes it italics/ she returns back to the article/ reads/highlights another sentences/ copies them (00:18) / returns to the Word document and pastes it/ writes a title in the Word document MARKET CAPITALIZATION/ makes it bold/ put the paragraph under it] ok ahh maybe because this this the first article I felt this information is important for me ahh (.) I will make it like this now and then when I read more paper I will add and delete and modify and paraphrase from the paper [she opens the articles and reads] Ops [she accidentally jumped to the end of the article and misses the page where she was reading/ she returned back to where she was reading/ she points with the cursor on the sentences that she is reading/ she re-reads the paragraph for three times (00:24)] this information is not related all the rest is not important for me but I see the rest of the paper if there is relevant information related to the GCC in general that I can use about the stock market and how it affects and does not affect just I want to collect some information in general [she scrolls down the pages using the side bar] just I want to collect information in general [she scrolls the page down using the side bar] I skip all these parts [She stops at the end of the final paragraph of the section/ moves the cursor on the sentences that she is reading using the side bar (00:73)] here I read the conclusion of the paper (.) I think I had what I need form this paper I see now the reference as I used three references so it is important for me to return to the same point that I was looking for [she moves on to the reference section/ reads/ points with the cursor on the sentences / highlights references/ copies / opens the Word document/ pastes them in the Word document/ returns to the reading paper/ reads/ points with the cursor/ highlights another reference (00:47)] I remember I read this paper before [she scrolls the page down/ reads/ highlights another reference/ copies/ opens the Word document/ pastes the reference/ opens the articles/ reads/ points with the cursor/ scrolls the page down slowly (00:38)] this is also important (.) I care about the date of the article I look for the new one [she highlights another reference/ reads with her finger/ points on another reference/ scrolls down/ points with her finger/ highlights a reference (00:18) /copies it/ opens the Word document/ pasts the reference/ opens the reading article/ completes reading the references/ points with the finger on the screen for each line (00:25)] ok

[she opens the Word documents/ reads what she pasted] but I am searching about this it is very important where it was? [she points to specific reference in the Word document/ opens the article/ reads the reference again and moves the page up using the side bar (00:9)] ahh I used it [she opens the Word document/ reads/ points at specific sentences] say capital market data base capital market data base [she opens the article/ reads the reference (00.07)] ok (.) so if I want ahh [she opens the Word document/ reads in the Word document/ points with her finger] this very important capital market data base and here [she returns to the article and re-reads the reference] and here capital market data stock ok [she opens a new webpage/ opens the Word document/ highlights a reference title / copies it/ pastes it in the search tool bar in the new webpage/ opens a journal/ reads through the titles/ chooses one article/ opens it in a new tab/ downloads it] I usually save it and connect it to the endnotes (.) so I can put the reference later on (00.05) [she opens the downloaded article] so it is in Arabic [she reads the title/ uses the side bar to move the pages of the article down/ reads quickly with her eyes (00:47)] it is too much and includes lots of details not this one [she closes the page/opens the Word document/ highlights and copies the reference title CAPITAL MARKET DATABASE/ pastes it in the Google search space] capital market database [reads/ scrolls down/ moves through the research result titles/ chooses one of them/ opens it in new tap (00:15) / she reads the title and the abstract (00:21)] also it is not relevant [she closes it/ opens the previous journal] ok maybe this one is useful I will keep it for a while [she opens her own folders/ reads through the titles/ choses a specific folder/ opens a specific PDF article (00.20) / returns to her folder/ reads through the titles/ chooses another PDF article/ opens it/ closes the Bookmarks/ minimize the size of the article on the screen using the minus icon (00:10) / reads the title/ scrolls down using the side bar/ reads the introduction/ points toward the introduction using her finger (00:15)] this was talking about the capitalization ahh I can add it here [she returns to the Word document/ re-reads what she wrote previously in the Word document/ points with her finger and moves the cursor on the sentences] ahh [she returns to the research article] I read that to be sure what information that I can add from this sentence (.) I highlight it and write a note that it talks about the capitalization in the stock market in the GCC so ahh here it says that [she points with her finger] it increases from 2000 to 2007 ahh does it increase or decrease! (00.22) [she re-reads the highlighted sentence] it increased hum [she re-reads the sentence for the third time with moving the cursor on the sentence while she is reading/ opens the Word document/ re-reads what she wrote (00:20)] I think I need to read more information about it [she opens the article/ scrolls the page down/ reads with pointing with her finger into the sentences / reads/ moves the cursor on the sentences / points with her finger/ reads/ highlights several sentences in the middle of the paragraph/ re-reads them/ scrolls down/ continues reading/ points with her finger on the sentences (00:58)/ opens her own folder/ reads through the titles/ choses a specific PDF file/ opens it (00:09)/ minimizes its size on the screen/

scrolls the page down and stop in the introduction/ highlights specific sentences / re-reads them with pointing with the cursor/ points with her finger/ copies them(00:37)] this maybe introduction the global what happened and then [she opens the Word document/ pastes it/ highlights it/ makes it italic/ changes its font and size] I should put reference here (.) this is global and this GCC but this also talks from 2002 to 2011 but also I am looking for something about how the market changed ahh value or market capitalization in the day of the crises ok this I want to make it linked this is supposed the information that I am looking for [she opens the research article/ re-reads the introduction (00:14) / highlights the word VIGOURSLY and copies it] this word I don't know its meaning I open it in Google scholar ahh I mean Google translate [she types Google translate in the search bar/ pastes the word in Google translate/ pronounces the word in Arabic] ok [she opens the Word document/ pastes the word/ clicks right click on the mouse/ clicks synonyms/ gets the meaning in English] just I want to be sure because sometimes Google translate doesn't provide me with the word that suits the topic it translates it in general in anything so I get sure from the financial side it suits so I put it here I find its synonyms to see more than one meaning for it and then I return and re-read to be sure of the word that its meaning suits here [she moves the cursor on the sentences while she is reading/ scrolls the page down using the side bar/moves the cursor on the sentences /stops/ reads/moves the page down/stops]

## **J.2 Transcription - Stimulated Recall Sample**

### **MAH/Master/ Education/ Stimulated recall/Digital reading/First phase**

What were you reading here at the beginning (00:18)?

Ok here I read the title and the writer of the article (.) actually I knew the title of the article but I re-read it again to fresh my information about the paper.

What were you reading here (00:25)?

Hum I read the abstract (.) I tried to understand the idea of the paper (.) what they did and what was their results (.) I was thinking also about my topic and if these paper would be helpful for me or not.

Why you said the abstract is not relevant to your topic (00:54)?

Yes because it was talking about classroom punishment (.) I am not interested in this exactly but I thought that if I read more in the article I may find something interested.

Why you said here I am reading fast, why were you reading fast (01:20)?

Because I don't need to read in details (.) I am just trying to find interested information or something relevant to my topic.

Why here did you return back (01:37)?

Ok because I realized that I skipped the beginning of the paragraph (.) I needed to return back and read the beginning in the previous page.

Why here were you pointing with your finger (01:39)?

Sometimes I point to focus on the sentences (.) when I feel that I missed something or I am not on the right track I use my finger to follow the sentences.

What did you write in your notes here (03:32)?

I wrote the references for these studies because I want to return back to them later on (.) I write them down to remind myself later.

Why you paused here (03:37)?

Because here I noticed that there are studies about the misbehaviour which is one of my focus (.) at the beginning when I read the abstract and started to read the introduction I thought that the rest of the paper may not benefit me in my assignment (.) but here I found something interested (.) here I re-read this information these sentences because I wanted to because that what I understood is correct

Do you usually write them in your notebook?

I write them in my notebook ahh but sometimes if I was reading online I directly search ahh I read the first part and if it was interesting or relevant I save it but if I was trying to focus on specific thing or I was reading from printed paper I write them down and then I return to them later on (.) sometimes I write notes about an idea or information that attracted my attention usually I write on it just a notice so I can search about it later on (.) I am not familiar with onscreen reading (.) I usually print the paper and highlight and write my notes on the paper itself (.) what I did now is what call skimming (.) after that I need to print this paper and re-read again.

Do you type your notes on your computer?

No I do not do that usually I write everything here either on the paper itself or in my notebook.

What were you writing here?

I was writing references because I want to return to it later on (.) usually when I am reading in specific topic and I don't want to stop my reading (.) I write them down to remind myself later on.

Do you usually write them on the paper?

Most of times I write them on the paper (.) sometimes I go to it directly (.) when I want to read specific point deeply and I don't want to be involved in another topics I only write notes for the reference to remind myself later on so I can use them later to search for them if I needed (.) actually rarely I return to them (.) Here I wrote notes just I put mark to myself so I can notice that there is something important here or there (.) I do not prefer to read onscreen (.) I print most of the time (.) I print a lot.

What were you doing here (03:43)?

I was reading in details actually I read the first sentences here several times because the information was very important and has relation to my study (.) ahh also I was thinking about how can I connect the information here with the one that I have in my mind (.) to be honest I was doing an extra effort to read here (.) I don't read from the screen all these kind of details (.) usually I only read the main titles and the abstract and then I print and read the paper or not.

Why were you pointing with your finger (04:08)?

Actually when I do this I feel that I concentrate more maybe because I used to do this when I read on paper (.) but It helps me to focus on the sentences (.) usually when I read onscreen I cannot concentrate on the sentences (.) I don't prefer this kind of reading (.) it is very tiredly

What were you doing here?

Actually here I read the first two sentences of this paragraph (.) it was an introduction about school violence and what it is (.) I don't need this information but I read the rest of the paragraph (.) I need to read maybe there is information that I may use it.

Why were you confused here?

Ok my research is not about punishment (.) ah it is about the students' misbehaviour and when I read about the corbal punishment (.) this was my first time to read and know about this (.) I wanted to know about the punishment and the strategies of punishment (.) actually this is my first time that I know that they here use the corbel punishment and there are people who support for it (.) so I wanted to read and know why those people are supporting it (.) I think I should include it in my research I(.) that is why I read about it (.) I found this in the first article and It was mentioned very briefly (.) ahh I needed to read a whole paper about it about its definition.

How do you usually search for these articles?

Ahh I have in my mind that usually I search in the psychology journals or educational psychology because of all my research is about these (.) I only choose the one in the psychology (.) did you see here when I searched I only chose the one in the psychology.

How did you know that?

My supervisor actually mentioned this to me from the early beginning (.) but if I did not find in these specific journals I read other ones it is not a problem but there are other researchers that I put them in my mind such as close and others

Why here were you reading very fast?

Ahh here I was not reading (.) I just wanted to finish that part and start the following one (.) ahh because I read the first paper of the paragraph or this section and I did not feel that has important or relevant information so I read it quickly to read the following section (.) I was reading very fast because I wanted to know at least that I did not miss anything (.) ahh ok I am searching in the misbehaviour but I don't need everything about it or for example this topic undercover agencies in schools (.) I don't need to read about it because I want information related to misbehaviour or the punishment so it attracted me here the con\*\*\*

What did you write here (05:36)?

Here I found this idea is relevant and I may need to include it in my assignment (.) I wrote it down.

Why did you skip all this part?

Because it is not relevant to my topic (.) I am not interested to read about it (.) I found here they were talking about something completely irrelevant to my topic actually it is related to psychology and I cannot understand it anyway.

What were you writing (06:08)?

Here I was writing main ideas of the article and summary of the whole article because if I needed this article or I came across it later I can remember what it includes.

What were you translated here (07:24)?

I translated this word corporal (.) I needed its Arabic meaning

Why you did not read its definition before you translated?

I need to translate first (.) then I read the definition

Was the definition clear and understandable?

Yes but at the beginning I did not read the definition (.) when I read corporal I did not understand the meaning of the word (.) I needed to stop and translate it to know its meaning before I continue reading.

What did you write here (09:01)?

Ahh I wrote this kind of punishment and its meaning in Arabic

Why?

Just to remind myself and not to forget (.) actually I prefer to write these kind of information on the paper itself but here because I am reading on the screen I cannot I think I will print the paper and read it again and write my notes on it.

What were you reading here (09:30)?

Ok here I needed to focus and read the information several times because here they talked about these numbers (.) they are results of another study about the classroom punishment (.) I needed to re-read it to understand the information (.) it is very important.

What were you translating here (09:56)?

I translated the word lashes I don't know its meaning

What were you doing here (10:42)?

Actually I re-read the sentence I was connecting the Arabic meaning of lashes to the rest of the sentence.

What did you find?

They were describing the word

Why you returned back (11:42)?

I needed to remember what is the main topic of this section (.) at the end there I have got lost about the main idea of the section (.) I did not know what they are talking about (.) I re-read the first part of the paragraph to remember its main idea.

Why here were you searching about this topic (12:24)?

Actually I wanted to read another paper about the corporal punishment in schools (.) the previous paper was somehow complicated

What were you doing here (12:26)?

I was reading these suggested findings but I remembered to search in Google scholar it gives me academic paper directly

What were you doing here?

I was reading the titles of each paper (.) ahh I chose this (.) the last one

Why?

Ahh when I read its abstract these couple of line under its title I thought it may contain relevant information.

What were you doing here?

I had a quick look at the paper but I observed it is very old and its written style is very old (.) ahh I did not read the information

Why did you type these key words (14:05)?

Because I needed this sort of information I don't want to read about this punishment (.) I want to know about its effect.

Where were you doing here with the suggested findings (14:39)?

I was reading the titles and the sentences underneath each one (.) but I did not find any suitable one that I can read about this topic (.) thus I moved to the next page here also I was reading these suggested findings.

What you did not read this one (15:10)?

Because it is not opened to public (.) ahh returned back and read another one here (.) I found this one

What were you doing here?

Actually here I read the title and the abstract and then I read the titles and the beginning of these tow paragraph only (.) here just I wanted to check if this paper relevant to my topic or not

Why were you pointing with the pen toward the sentences on the screen here (16:55)?

Because the font were very small and it is written in two Columns (.) I cannot concentrate when the page is full of information like that I need to follow by the pen to focus on the sentences that I read otherwise I lose the line that I am reading.

What here?

I remembered that I can enlarge the page (.) so I enlarge it a pit to be clearer.

So why were you using the pen again here?

Because it is still small (.) and also all this information I wanted to read very carefully and understand them

Why were you using the pen here?

Actually I lost my concentration and I felt board (.) I use the pen here to do some action makes me focused on what I read.

### **J.3 Transcription - Interview Sample**

#### **SAJ/Master/ Health Science/ Interview/First phase**

Q.1 would you please discuss how you learned your Arabic and English reading skills in your home country, How do you evaluate your experience and your reading skill knowledge?

I studied English language during the preparation year (.) there was a reading class

What was the used the materials?

It was a textbook in both semester (.) it contained reading in the medical field it was about human body parts and stuff like these.

How was your tutor teaching you reading?

She was explaining the topic and then we were reading loudly (.) and then we discuss the questions (.) we were reading loudly in the class (.) I was feeling very confused when my turn comes because I was hesitating when I read and I was a afraid of reading loudly in front of others

in English (.) also I was confused because in the same class there were students who studied in private schools and their English language were much better than mine (.) they were fluent in reading (.) but my reading was very bad (.) I was practicing reading aloud at home to avoid hesitation in the class and I was hesitant when I read (.) actually it was horrible the reading class. Did your tutors encourage you or gave you any kind of reading to read online or find about specific topic online?

No (.) actually we were reading only from the text book (.) sometimes she was asking us to read before the class and asks us to answer the questions after the passage (.) also she was encouraging us to translate what we read (.) at that time we were using the translator machine (.) none was digitally

Do you use the translator machine now in your reading?

No at all I don't need it now.

Q.2 would you please discuss your previous academic reading practice when studying for your bachelor's degree in Saudi Arabia, (Printed and digital)?

Q.2a would you please discuss your reading experience in the academic libraries during your stages of study in Saudi Arabia?

Actually you mean during my school year I did not use the library I don't think there was a library in schools (.) ahh during my bachelor I used the library in my university to borrow some books (.) most of the time I borrowed the books and copied specific sections and read them at home (.) usually I go to the University library to borrow and read books and collect information and then write them down in my notebook (.) I borrowed books that covers repository diseases and printed the chapters that cover related area and look for the diseases from different text book and then present my information.

Q.2b What kinds of material did you read? Were they books, teachers' hand-outs or research articles? Which materials did you read the most and the least, and what was the reason for this? For my study I read textbook sometimes I read from hand-outs and PowerPoint slides (.) ahh actually my background was medically focus so I focus on text book related to medicine I have no other chance for reading for general stuff mainly I focus on text book because it has a lot of materials to read and cover in the bachelor degree in a short period of time and also medical articles available in my medical university library but I mainly read text books related to Medicine (.) ahh and some teachers' hand-outs.

Q.2c What about reading research articles? How often did you read these and why?

The least were research articles (.) maybe a week I would cover one (.) ahh maybe in exam I cover ten in one day (.) I read most of the time this is what helped me in my bachelor study (.) most of the time I read every day (.) ahh at the beginning during my bachelor I found it very difficult to read a research article (.) the information was very intensive and the words were written in a very small font and sometimes two columns and in English

Q.2d What was the purpose of your academic reading? Was it for writing assignments, taking exams, learning, or participating in lectures? Which purpose was used the most and the least? During my bachelor study they might ask us to look for something about a drug or a disease sometimes we do clinical practice so we go to the hospital and see a case with specific disease so I go and find an article that describe that disease and explain why it happens and the incidents. What do you mean by looking for something?

I mean search and provide them with two pages or three pages and sometimes they ask us to prepare a power point presentation to describe a specific disease.

What do you do for that?

Actually during my bachelor I did not write an essay and it was a chock when I came here and they asked me to write an essay (.) actually I asked what is essay and how I write it I have not covered that during my bachelor it is a new concept (.) the point here is that I did not have any assignment

during my bachelor study but sometimes the teachers asked us to look for something such as specific disease or drug and find information about it and write in two or three pages, to be honest when I came here ahh I had no idea about how to write an essay (.) ahh we had lots of exams and also I read to attend clinical examination during my bachelor.

Q.2e What kinds of material were you reading for each purpose and why?

Q.2f How often were you reading each material for each purpose?

Yes I don't depend only on what the teacher give me but I read other thing online ahh (.) I needed to read every day because my filed was difficult and because they usually the exam is not only covered with what they gave us but also other stuff as well.

Q.2g Were you only reading before the deadline of your specified purpose or regularly during your course? If so why?

I was reading regularly to cover what the tutors ask us about

Q.2h Were you reading lots of materials to achieve your academic purpose or only for your specified course documents? Please explain why this was the case.

Yeah I read every day because they gave us a lot of material every day and I need to catch up (.) actually the thing that made me progress during my bachelor was my further reading (.) I did not only depend on the text book or what the lecturers provided me I go ahead and find another sources.

Q.2i What were the steps that you followed when you read for each purpose? Please explain this in greater detail.

Q.2j What sources of materials did you read? Were they printed or online? What did you prefer and why?

all the materials were in hardcopies (.) when I read online I lose my concentration so I printed out everything if it is really related to my course and interest I would prefer to printed out and highlight and use pen to guide me (.) ahh when I read online I lose my concentration also I like to use the pen and highlighters (.) write comments like this (.) the most important thing about reading print is that I love follow my reading using my pen or thump this makes me concentrate (.) it is difficult to do this online.

Q.2k What did you understand better, reading online or hard copies? Why was this?

Sure I understand better the printed paper.

Why?

Because I can focus more on the reading and understand more than when I read digitally.

Why you can focus on the printed paper and not the digital one, what is the different between them?

Ahh when I read on my laptop there are millions of things that I feel that I want to do such as checking my email my tweeter Facebook

what about text books do you read online textbook?

No I don't prefer online books I don't like studying from ahh studying for exam from online recourses no I cannot do that and also I don't prefer it at all because I find it much more easier to read the hardcopies than the eBooks (.) ahh I can follow with the pen I feel my brain focus more when I follow with the pen so I have this habit to follow with the pen ahh I do use highlighter to highlight things and important terms to remind me and make it more easier to find and of course keep the article as a reference if it is very important to read it again later on otherwise I will lose it in a lot of folders on my desktop

Q.2l Were digital services that supported your digital reading available in your home country?

How did these affect your reading?

Yes I had my laptop and access to database through my university (.) I think they are managing to get a Wi-Fi throughout the whole university.

Q.2m Were you practicing any form of online social reading?

Sometimes

Q.2n Were you reading with other colleagues? If so how often and was this online/offline?

At the beginning of the bachelor a lot of students because we were studying in a new language and find it very difficult (.) at the beginning we were forming a group study to study (.) actually I found it time wasting because it was not organized it was very confusing (.) to be honest I prefer

to study alone because the interest are varies because sometimes I want to focus on specific thing while my friend wants to read and focus on something else that I am not interested in or I do know it already I don't prefer to study with others.

Q.2o Were you sharing comments with other colleagues? If so how often and was this online/offline?

No (.) ahh I did not get involved in these kinds of practices because I do not prefer it.

What about sharing ideas after reading?

We do share it once the teacher mention or say something relevant to what I have read I would raise my hand and talk about that article that I have read to support that or for example against (.) medicine change rapidly so the teacher might say something which is outdated so I would find it a good opportunity to say my point.

What about sharing online reading?

We had a form and if I found something interesting I would posted there but I have not carried any thin like that

Q.2p Which sources (affordances) did you use when you read print and online documents (e.g. a dictionary, a pen and notebook, a PC, other articles etc.)?

Actually during my bachelor I used the computer to search for the information I rarely read from screen

Q.2q Do you have anything else that you would like to add about your previous reading practices when studying for your bachelor's degree?

no

Q.3 would you please discuss your previous academic L2 reading course which you undertook prior to starting your postgraduate study?

Q.3a What have you learned about reading in the academic course?

I think it was more about writing not reading we were focusing on taking notes and paraphrasing I knew how to skim and scan but I do not think it added to my academic reading

Q.3b What kinds of material were you reading in and outside of the classroom (e.g. text from the course book, and/or academic/general research articles)?

They gave us hand-outs, they were a photo copies from a book (.) ahh we were reading from the teacher's hand-outs, it was photocopy from a text book mainly and sometimes from the text book (.) we covered only a few chapters of the textbook.

Q.3c What source of materials were you reading, online or offline?

All were printed (.) nothing were online.

Q.3d Have you been taught to read online? If so please explain further.

no

Q.3e Have you practiced reading online in the classroom/outside of the classroom?

During this course! We had no time to practice online reading inside the classroom (.) in the class room we were reading from printed paper nothing was on screen.

What about outside the classroom?

They gave us an access to the toolkit EAP toolkit ahh in the independent class the teacher gave us access to the Toolkit and she focussed on our weakness by using this Toolkit.

Did your teacher try it?

No we had ILA or independent learning tutor she helped us to focus on our weakness point we discuss with her one to one about what we want to improve

Did your reading tutors introduce you to technological reading affordances and did they encourage you to use some of them during reading?

What do you mean?

I mean ways and strategies to read online?

No

Q.3f did your teacher encourage you to read extra materials online or offline outside of the classroom?

No the teacher was giving us specific text to read and understand at home.

Q.3g Did you read printed or online research articles in the classroom/outside of the classroom?

No we did not read a research article during that course (.) I think the tutor at the time had no background in research I think that

you said the teacher was giving you an article? What kind of article?

It varies (.) sometimes they gave us articles about business (.) not exactly a research article it was general report for example about Greece crises (.) ahh about immigration civilization a kind of passages

Q.3h Have you been introduced to the information structure and organisation of research articles?

No, nothing like this was in this course.

Q.3i Which sources (affordances) did you use when you read print and online documents (e.g. a dictionary, a pen and notebook, a PC, other articles etc.)?

Nothing because we were not reading online.

Q.3j Did your reading tutors introduce you to technological reading affordances and did they encourage you to use some of them during reading?

No (.) just as I told you in the independent class (.) the tutors were there If we had any question about anything when dealing with the Toolkit

Q.3k Were you reading in groups in the classroom, outside of class; and online or offline? If so please explain further.

Sometimes we were reading in the classroom with my friend and we were explaining for each other the difficult points (.) ahh online (.) we did not practice or tried ever to read in group online (.) I do not know how it happens.

Q.3l With regards to your essays and final assignment, how did you prepare for these? Please explain further.

I searched online and found references maybe three or four that are related to the topic that I chose and used them to write my essay ahh (.) it was about technologies related to my field of practice (.) they gave us several topics and I chose topic related to my field (.) I searched on line and found three or maybe four articles related to that topic and wrote an essay (.) it was about 1300.

Q.3m How do you evaluate your English reading course in terms of its effectiveness, learning something new such as reading strategies and ways of reading, etc.? Please explain.

To be honest I think I did not gain anything related to reading in this course (.) it was only just read at home and provide us with a summary and notes whether it took from you one hour or three days it does not matter (.) the most important thing was to provide the teacher with a summary and notes about what we read ahh (.) actually in the reading course the tutor for reading and writing was the same and actually during the reading class or the writing one I could not distinguish between (.) is it a reading or a writing class because they mix it (.) the reading course in the pre sessional was mixing between reading and writing (.) it mainly was about writing for example writing notes, summary like this but I did not learn the reading skills that could improve my reading and understanding (.) for example the teacher gave us an article and asked us to read it at home and then write a summary (.) we did not practice the reading skills in class (.) to be honest I did not get any knowledge about the reading skills (.) even the mentioned skills in the book the teacher was just telling that there are skimming and scanning but there was no practicing (.) she just introduced us to that concepts but we did not practice it in the classroom (.) I think I did not gain knowledge in reading skill.

Q.3n What do you think the academic English reading course added to your academic reading skill?

It was summary and taking notes about specific texts.

What about skimming and scanning?

The teacher said these strategies in the class but she did not show or practice how we can do them. I don't know I did not gain knowledge in reading skill to be honest ahh I don't think I gain

anything related to reading just they gave us passage and ask us to read it at home and then provide them with summary and notes.

Q.3o What did you need from this course regarding your reading skill?

I need something help me to read in an efficient way for example extracting the important information (.) I need skills to guide me to catch this information for example looking for key words that would give me a full understanding and make me read faster I think I cannot read very fast I am very slow reading.

You mean online or offline?

Both ahh I am not fluent at reading at all I stop and pause a lot ££ This is the weakness skill in the IELTS the worse it was 5 Actually the problem was in my reading was the time I do really need time to read and understand.

Q3p Do you have any thing that you would like to add about your previous academic English reading course?

No thank you.

Let us now move on to your current academic reading in your field of study within the UK context.

Q.4 would you please discuss your current L2 academic reading practices in the UK? (Printed and digital)?

Q.4a What kinds of material do you read the most and least (e.g. research article, reports, and textbooks)? Why was this?

Research articles mostly but sometimes I read the books because my discipline now is respiratory care but I want to focus on neonatal so I want to increase my information about the neonates.

Q.4b What was the main and least purpose for what you read?

The main purpose here is writing assignments and gaining more knowledge and information about my field.

What do you do when you write?

Usually I put the paper in front of me (.) I highlighted and underlined and put notes I write for example I need to use this and paraphrase it and then write in my Word document.

Q.4c Did you read differently when you read for each purpose?

I do not think I read differently.

Q.4d What source of materials did you read the most and least (e.g. online and/or printed)? Why was this and which did you prefer?

I read more printed paper (.) I prefer printed (.) particularly if the article was very much related to my topic and interest (.) I print it out immediately.

Why?

When I read on printed paper I can concentrate more and read for longer time than reading on the computer (.) ahh also because I like to highlight and write notes on printed paper when I highlight and write notes online it takes more time than when I read on paper (.) If I need to read specific paper and the assignment about specific paper I print it and read it from the printed paper but if it is one from a list of papers I read it online (.) ahh It depends if I see strong relevancy I print them out if it needs me to highlight and write notes (.) if it is about an important topic I printed out but otherwise if skimming and scanning I read it online only to pick up the important information.

What do you understand better?

Of course I understand the printed paper better than the onscreen one.

Why?

When I read online paper I quickly feel bored and do not want to complete reading and I lose my concentration (.) I lose my concentration when I read online particularly in English I understand better the printed one (.) ahh also because I can use the highlighter and write comments and save it I think reading from the printed paper is more convenient than reading on the screen (.) as I told you I can follow by my pen or finger (.) when I read onscreen usually I think about opening my tweeter or unrelated thing check my emails send social emails to my friends exchange emails plus

I usually use my laptop which has small screen so I need every time to go down and move the scroll bar to move the page I feel I save my time when I read printed paper I can read for more time and concentrate more also I like to highlight and underline (.) ahh if I found a material that is very important and related to my topic I print it out otherwise I read online only for getting general idea I can highlight but it consumes more time I find it faster when I do it on printed paper (.) also when I write notes it takes more time when I do it digitally everything that I want to read it in details I print them

What do you read online?

At the beginning when I do search about specific topic and found for example twelve articles of course I will not print them all (.) I read them online (.) I do skim and scan if they are relevant and fit and I can entirely depend on them in my assignment I print them (.) but actually I don't know what I am going to do when I write my dissertation because I need to use many references I don't know what I am going to do (.) ahh to be honest I prefer to print everything but I want to save money and paper (.) ahh here I need to read a lot of research papers and it is really too much to print everything (.) sometimes I only read the beginning of the paper and then I find it not related or has no valuable information so I ignore it or I don't read it again (.) but It is much easier to read the printed paper than the online one because when I read the information on paper is totally different than reading it on screen even if I put it in folders for example now I have folder in another folder all this about specific topic it is really confusing.

Q.4e How much reading do you do now on a daily basis? At the beginning of your time in the UK do you feel that you read more or less when compared with the time when you studied for your bachelor's degree?

Now I read around two to three research articles every day plus I read chapters and sections from several books (.) my course is very intensive and I need to gain more knowledge and recent information about my field.

Q.4f how do you read a research article associated with your own field of study?

I start with reading the abstract and then the methods and check if they are valid and correct and then I re-read the whole paper gain (.) I read it from the beginning till the end the conclusion but usually the method of the study is the most important thing in the paper because it gives me indication if the study is good or not If I want to take notes from it I need to concentrate (.) I put symbols where the gap of knowledge where and look for the aim of the study (.) I put comment where they brought previous studies supported their ideas (.) ahh Usually I prefer to read the abstract and then read the methods directly but when I read qualitative study and I am not interested in that (.) because I prefer the methods which are quantitative that have sample size and results based on statistics (.) usually I jump to the methods and see what kind of questionnaire how they made their data analysis and was there bias in the selection or not.

Q.4g what are the important parts that you look for and focus on, when reading a research paper? After searching online I read the abstract because the abstract has mostly everything about the paper if I found it interesting and has good information I print them.

Q.4h would you please discuss your use of the following reading strategies? How did you use them and for what purpose?

What about writing notes on screen

I just discovered that recently that I can make notes on the PDF files but during my bachelor I did not know that.

Q.4i What do you know about critical reading? How and when do you apply this and how did you learn this? Please explain.

I am not very well in criticality (.) actually now I am having a course called critical appraisal (.) I am leaning how I can critique a paper or a study (.) they are teaching us how can I criticise the research and to use critical appraisal tools (.) actually in this module they give us tools to assess if that article is valid or not and its results are correct and how they reach it either by bias or by correct ways I think it is a bit complicated and needs a lot of thinking

Did you study anything like that back home?

No not exactly.

Q.5 Can you discuss your use of technology for academic reading?

Q.5a When did you start using technology to study and particularly to read in the academic field?  
During my bachelor

Q.5b Which digital sources (affordances) do you use when you read print and online documents (e.g. an electronic dictionary, YouTube, a pen and notebook, a PC, other articles, other references, words, Excel, an iPad, an iPhone, reference programs, blogs, wikis, Endnote, reference manager and Mendeley, etc.)?

Sometimes when I cannot print the paper because of any reason I highlight and put notes on the PDF file and then when I can print I print it and then I add notes (.) I remember during English course when they gave us something related to something else in English and not related to medicine for example reading a text about civilization I cannot understand anything I was very difficult (.) my English is around the medical field so at that time I was indeed printing everything and most of the time I copy and paste the paragraphs in Google and make Google read digitally and translate the whole paragraph (.) my problem is my reading is very slow and I lose my concentration so when I listen to it this makes it easier for me to understand (.) when the computer read it for me it became easier than I read it (.) actually sometimes I do this when I read now the medical articles this makes me understand better (.) this happen in the first stage when I read and skim and scan but when I start the stage to take notes I print I write down on the paper itself (.) usually I listen to the text when I lose my concentration (.) ahh I insert each paragraph separately to avoid hanging the computer (.) ahh I search online sometimes I read and use Google translator to translate and read (.) I think these are what I use the computer for when I read.

Q.5c What do you think about digital reading, digital reading affordances, and gaining assistance from digital textual resources? Do you find them helpful, not helpful, or don't you know?

Well I think they are useful (.) facilitate reading but I prefer the printed one because I think using these affordances would consume more time than only reading from paper.

Q.5d Has the availability of digital services in the UK academic context affected your academic print and digital reading? Why is this?

No (.) because everything was available in my home country as well.

Q.6 would you please discuss the reading challenges which you encountered when reading a research article in your own field of study at the beginning of your academic study in the UK? (E.g. reading strategies, content knowledge, linguistic knowledge, text organisation) whether (printed and digital)?

Reading the English material at the beginning I mean during my bachelor was very difficult (.) mostly I used to translate difficult words using my translator machine and Medical dictionary to translate lots of words while I am reading (.) but after that I learnt lots of words and I don't need to translate each word (.) Actually I take long time to read (.) ahh when I read I take times actually I am really slow in reading and I take long time to finish reading one paper (.)The problem here is that they asking us to search and read about things and topic that when want and interested in this make me very confused with what I should read and what I should not (.) sometimes the spelling between the American and the British writing makes me confused (.) ahh also when I read about new procedure ahh (.) for example when the article present a new procedure that they did for the patient and I do not have any background about that procedure (.) also when I read online I like to follow the sentences with the pointer I cannot read only with my eyes.

Q.6a how did you overcome these challenges?

I try to avoid reading online only when it is necessary or I cannot print.

Q.6b What are the reading challenges that you are currently encountering during your academic L2 reading of research articles?

Because I take long time thinking about what I am reading for example when I finish one paragraph I stop and start think about it and then I try to get an idea from that paragraph and then I move on for the following paragraph I don't read everything all together I read each

paragraph and understand it and then I read the following one that is why I take long time (.) you know reading for studying is different than reading a story also sometime I read one paragraph and then finish understand it and then I go back and read the previous one to connect the ideas in this way I need to think about the previous paragraph again to connect the ideas in the two paragraphs together (.) ahh I lose my concentration for example I start reading a paragraph and then suddenly I do not remember what I was reading (.) ahh most of the time I get bored when I read ££.

Do you mean when you read online?

Both (.) I need to take regular break when I read ahh I cannot keep reading for long time.

Can you talk more about this?

Ok when I am forced to read specific thing and about specific topic or to write an assignment I read less than what I read a topic that I am interested in (.) ahh when I am interest in specific topic I feel that I am interested to find the answer so I search and read more than reading for something that I am not interested in I can drink coffee ££ and read for long time but when I am forced to read unrelated thing I take break regularly (.) another problem I have is facing new words that I don't know before

Q.6c How do you try to overcome these challenges?

I translate them

How?

I use Google translator (.) I copy and paste them in Google and I f I was reading from paper I write them on Google (.) sometimes I try to understand the words from the context.

What kind of words do you translate?

Mostly medical words that I did not come across before.

What do you do also to overcome your reading challenges?

I do read it again and try to focus (.) only reading in English makes me lose my concentration I try to keep taking notes and summarising things in my note book to keep me focus and follow what I am reading (.) I try to re-read the text more than one time (.) most of the time when I read something new that I do not have an idea about it I go and try to find it in another references online and read it online (.) for example research methods that I do not know how can I criticise it if I don't know it so I search and read about it so I can know if they use it properly or they just did it to get any result so I read about this method and read if this kind of methods are suitable to this kind of research or not (.) I read about that research methods and see if that kind of research can take this kind of methods or not because sometimes they apply methods that does not generate very good findings and if they used another sort of methods they may get better results so here I criticize the research.

Where did you learn that?

I have learnt this here in one of the module in the university.

Q.6d was the reading of research articles at the beginning challenging for you? Why was this?

What about now? Please explain.

Actually reading a research article is not a problem for me but understanding the knowledge sometimes is difficult particularly when I don't have an idea about what they are saying in the paper I used to read a research article during my bachelor although it was not that much like now but at least I have an idea about it (.) I think what is challenging me now is reading a huge amount of papers in specific time (.) I am very slow.

What are the reading challenges that you are currently encountering during your academic L2 reading of research articles?

I am reading in another language I am reading everything in English I cannot concentrate and read fast as I read in Arabic but in English I need to concentrate and think while I am reading to understand although during my bachelor everything was in English I still have the difficulty of the language.

Q.7 Would you please provide me with an overview of what the changes have been that have occurred to your L2 reading of research articles practice and performance since you started your postgraduate programme in the UK until now, (printed and digital)? (e.g. reading comprehension, reading fluency, amount of reading and reading strategies)?

I think till now nothing changed (.) actually I am forcing myself to read more because need to follow with the courses.

Q.8 Would you please discuss the factors that have positively affected your academic L2 reading during your postgraduate study in the UK, (printed and digital)? (e.g. personal factors, social factors, and academic factors)?

Q.8a What kind of social activities which you are involved in the UK affect your academic reading? Actually I met one native speaker and started an assignment together (.) it was interesting to work together (.) but I think this happened if I could not understand specific point or something I may consult some of my friends and share opinions.

Q.8b What are the roles of society and culture in changing your reading style?

I am still not engaged in this culture (.) I am not sure anything of this has an effect on my reading

Q.8c What is the role of the educational context in changing your academic reading practices?

This this the second month in my Master I do not think there are any thing changed in my reading (.) we started our modules and require us to read a lot in several topics

Q.8d What is the role of your previous reading education in affecting your current academic reading?

Actually my previous reading which was during my bachelor were all in English language (.) this made it easy for me now to read the English material and become familiar with what is going here.

Q.8e Does your inner speech occur in Arabic or English when you read English academic materials? Why is this?

No (.) I don't think in Arabic when I read in English (.) I think about the information that I read in English I mean when I read the medical information actually I do not know them in Arabic because as I told you I learnt all these stuff in English since I started my bachelor degree.

Q.8f What are the academic reading expectations of your tutors in Saudi Arabia and the UK (printed and digital)? How do you think this affects your previous and current academic reading?

I think here they want us to read a lot and know a lot of things but here I am not sure what should I read and what to do (.) in Saudi Arabia they are expecting me to know specific information only (.) I think in Saudi Arabia is much easier.

Q.8g What is the difference between your academic reading in Saudi Arabia and the UK?

I don't think there is a different between reading here and in Saudi Arabia (.) I am not sure.

## J.4 Original Version in Arabic - Sample

### Towards models of on-screen academic reading interaction

#### On-screen PROB sub-strategies

##### 1. Re-reading

*'I re-read these sentences several times (.) they include details about classroom management' (Ph2/SR)*

"كررت قراءة هذه السطور عدة مرات ( . ) كانت تتضمن تفاصيل حول الإدارة الصفية"

##### 2. Translating electronically

'hum I cannot understand this sentence (00:23) I will see [she highlights the sentences, clicks write clicks, copies the sentence, opens Google translator, pasts the sentence] ° directly applicable studies° [she reads the meaning] it is still not clear' (Ph1/TA)

"همهمة لا أستطيع أن أفهم هذه الجملة ( 00:23 ) سوف أرى [ أنها تحدد الجمل،تنقر على الفأرة، تنسخ الجملة ، وتفتح الترجمة جوجل، ماض الجملة ] ° directly applicable studies° [ تقرأ معنى ] هو لا يزال غير واضح"

### 3. Using context

'I was trying to understand the word consistently from the context. I was thinking what does this word means here' (TA)

"كنت أحاول أن أفهم كلمة باستمرار من السياق . كنت أفكر ماذا هذه الكلمة تعني هنا"

### 4. Pointing

'I started to lose concentration and I was trying hard to focus and understand. The pen helps me to follow my reading and focus' (SR)

"بدأت أفقد التركيز و كنت أحاول جاهدة على التركيز و الفهم. القلم يساعدني لمتابعة قراءتي و التركيز"

### 5. Ignoring difficult sections

'Here I could not understand the idea (.) I reread the sentences several times (.) also I reread the whole paragraph from its beginning but I could not understand what does he want to say (.) actually I ignored it' (Ph2/SR)

"هنا لم أستطيع أن أفهم الفكرة كررت قراءة الجمل عدة مرات ( . ) ا أيضا كرت إعادة قراءة الفقرة بأكملها من بدايتها ولكن لم أستطيع أن أفهم ماذا يريد أن يقول ( . ) في الواقع تجاهلتها"

'I did not read this part ahh if I faced difficult sections while I am reading on-screen and I don't need them I don't even try to understand them at all (.) I ignore them (.) if they are not relevant to my key points I don't confuse myself' (Ph2/SR)

"لم اقرأ هذا الجزء (.) عادة عندما اقرأ اجزاء صعبة على الشاشة وانا لا احتاج هذه المعلومات (.) عادة لا احاول فهمها وانما اتجاهلها (.) اذا لم تكن على صلة بالمواضيع الاساسية المهمة لي لا اربك نفسي بقرأتها"

'Sometimes when I don't understand the abstract and I still interested in the paper I keep reading it because I sometimes understand when I complete reading' (Intvw)

"أحيانا عندما لا أفهم الملخص و أنا لا ازال مهتمة في الورقة العلمية او اصل قراءتها لأنني في بعض الأحيان افهم عندما أكمل القراءة "

## 6. Connecting text content

*'Because I needed to remember the first one (.) ahh just to connect the ideas of the first diagram and the second one (.) they seemed confusing at the beginning because the first one was types of information and the second one was about types of information system (.) I needed to check this information (.) so I returned back to the first one' (Ph1/SR)*

"لأنني بحاجة إلى أن اتذكر أول واحد ( . ) آه فقط لتوصيل الأفكار من المخطط الأول والثاني ( . ) يبدو أنهم مربكة في البداية لأن أول واحد كان أنواع المعلومات و كانت الثانية حول أنواع نظام المعلومات ( . ) كنت بحاجة للتأكد من هذه المعلومات ( . ) لذلك عدت لأول مخطط وقراته"

## 7. Changing reading rate

*'Actually here I was slowing my reading because these are the key ideas in the paper. Here I did not understand what the oriented mobility assessment is (.) I needed to understand them. Also while I am reading actually I am thinking about the information and I am imagining the whole scenario, the study of the paper' (SR)*

"في الواقع أنا هنا كنت اقرأ ببطء لأن هذه هي الأفكار الرئيسية في الورقة . هنا لم أفهم ما هو *oriented mobility assessment* ( . ) أنا في حاجة لفهمها . أيضا بينما أنا أقرأ في الواق كنت أفكر في المعلومات و تخيل سيناريو الدراسة"

## On-screen SUP sub-strategies

### 1. Marking the text

*'Ok here they started the section with a question (.) I highlighted the question to focus on and search for the answer of this question' (Ph2/SR)*

"طيب هنا بدأ الجزء الاول بسؤال ( . ) سلطت الضوء على السؤال حتى اركز وابحث عن إجابة لهذا السؤال"

## 2. Pointing

'<I need the title of the paper or the link to return back to it [she scrolls the page up/ moves the cursor > (00:04) [she highlights the title of the paper/ moves the cursor >' (Ph2/TA)

"> أنا في حاجة إلى عنوان الورقة أو وصلة للعودة إلى ذلك [ أنها تمرر الصفحة لأعلى /تحرك المؤشر < ( 00:04 ) [ أنها تسلط الضوء على عنوان الورقة / تحرك المؤشر <

'She moves the cursor on the sentences while she is reading' (FN) and 'She points with her finger to the sentences and follows the sentences using her finger'

"إنها تحرك المؤشر على الجمل وقت القراءة ' ( FN ) و" وتشير بإصبعها إلى الجمل و تتبعها باستخدام إصبعها"

## 3. Pausing and thinking

'I highlight here [she adjusts the screen] (01:35) [she scrolls the page down] (00:50) [she scrolls the page down] (00:44) [she scrolls the page down] (00:37) [she scrolls the page down] (00:12)' (Ph2/TA)

"انها تسلط الضوء [ انها تضبط الشاشة ] ( 01:35 ) [ أنها تحرك الصفحة الى الاسفل ] ( 00:50 ) [ أنها تحرك الصفحة الى الاسفل ] ( 00:44 ) [ أنها تحرك الصفحة الى الاسفل ] ( 0:37 ) [ أنها تحرك الصفحة الى الاسفل]"

'I needed to think about these two sentences (.) I was analysing the words and trying to think about their meaning in the context' (Ph2/TA)

"كنت في حاجة للتفكير في هاتين الجملتين ( . ) كنت احلل الكلمات واحاول للتفكير في معناها من سياق الجملة"

'She is pausing for a while' (Ph1/FN)

"انها تتوقف عن القراءه لمدة قصيرة"

## 4. Confirming

'Ahh ok \*\*\*\* ok and then [she moves the page down] \*\*\*\* all right \*\*\*\* so they took people who are elderly and from the community' (HS/TA)

"آه طيب ° ° ° ° \*\*\* طيب و بعد ذلك [ انتقلت إلى أسفل الصفحة ] ° ° ° ° \*\*\* ° ° هذا صحيح ° ° ° ° \*\*\* ° ° so  
" they took people who are elderly and from the community

## 5. Taking notes

'Also here I had to write important information about the duration of the training eight weeks' (SR)

"هنا أيضا كتبت معلومات هامة عن مدة التدريب ثمانية أسابيع"

'Ok here I wrote the abbreviation of reference ref and this note here to write the title of the paper or the link so when I return to this document later on I can go back and reread the information from the original paper itself (.) ahh also I wrote here the kind of information for example here I wrote case study (.) sometimes I write background or definitions to guide me when I reread the paper and it also saves my time' (Ph2/SR)

"طيب هنا كتبت اختصار للمرجع و هذه المذكرة هنا لكتابة عنوان الورقة أو صلة ذلك عندما أعود إلى هذه الوثيقة في وقت لاحق أستطيع أن أعود بسهولة و اعيد قراءة المعلومات من الورقة الأصلية نفسها ( . ) هنا كتبت نوع المعلومات على سبيل المثال هنا كتبت دراسة حالة ( . ) في بعض الأحيان أنا أكتب الخلفية أو تعريفات توجيه لي عندما اعيد قراءة الورقة و ايضا يوفر وقتي "

## 6. Reading aloud

'° ° ° ° < elderly = [she writes notes] alright ° ° ° ° = (00:06) ° ° ° ° there is no difference' (TA)

"° ° ° ° > المسنين = [ انها تكتب ملاحظات ] حسنا ° ° ° ° = ( 0:06 ) ° ° ° ° ليس هناك فرق"

'If I feel the sentence is useful and related to my project (.) I reread it aloud and highlight it and return to my writing and look at where it fits in and then paraphrase it' (Intvw)

"إذا شعرت الجملة مفيدة و ذات الصلة بمشروع بحثي ( . ) أعيد قراءتها بصوت عال و اسلط الضوء عليها و اعود الى كتابتها و انظر حيث تناسبها مع باقي الجمل و من ثم اعيد صياغة الجملة"

'Usually when I read and I want to concentrate I vocalize. It helps me to understand better than only reading silently' (SR)

"عادة عندما اقرأ و أريد أن اركز اقوم بالقراءة بصوت . هذه الطريقة تساعدني على فهم أفضل من ما اقرءة فقط بصمت"

## 7. Vocalising electronically

*'When the computer read it for me it became easier than I read it (.) actually sometimes I do this when I read now the medical articles this makes me understand better (.) this happen in the first stage when I read and skim and scan but when I start the stage to take notes I print I write down on the paper itself (.) usually I listen to the text when I lose my concentration'* (Ph1/SR)

"عندما يقرأ الكمبيوتر لي تصبح قراءتها أسهل ( . ) في الواقع أحيانا أفعل هذا وأنا أقرأ الآن المواد الطبية هذا يجعلني أفهم أفضل ( . ) هذا يحدث في المرحلة الأولى عندما اقرأ بسرعة واتصفح المعلومات ولكن عندما أبدأ في مرحلة تدوين الملاحظات / طباعة أنا أكتب على ورقة نفسه ( . ) وعادة أستمع إلى النص عندما أفقد تركيزي"

*'It was hard for me to pronounce it as well. I used Google to get the meaning of the word and listen to its pronunciation'* (SR)

"كان من الصعب بالنسبة لي نطق الكلمة. كتبتها في جوجل للحصول على معنى كلمة والاستماع إلى نطقها"

## 8. Connecting text content

*'Actually here I saw the diagram first and then I needed to reread what is written before it (.) I knew that it is about another approach of information system (.) ahh I did not read about it in details I only needed to know what it is (.) then I returned back to the diagram'* (Ph1/SR)

"في الواقع هنا رأيت الرسم أولاً ثم كنت بحاجة لإعادة قراءة ما هو مكتوب قبل ذلك ( . ) أنا أعرف أنه عن نهج آخر لنظام المعلومات ( . ) آه لم اقرأ عنه بالتفصيل إلا أنني في حاجة إلى معرفة ما هو عليه بصفة عامة ( . ) ثم عدت إلى قراءة الرسم البياني"

## 9. Reviewing

*'I was revising the information that I read and I was revising my understanding just to be sure about all the information in the text'* (SR)

"كنت أراجع المعلومات التي قرأتها وكنت أيضاً أراجع فهمي للمعلومات وأنا بصدد تعديل فهمي لمجرد أن أكون متأكد من جميع المعلومات الواردة في النص"

*'I returned to the beginning of the paragraph because I wanted to check my understanding of the main idea of this paragraph'* (Ph2/SR)

"عدت إلى بداية الفقرة لأنني أردت أن تحقق ما أفهمه من الفكرة الرئيسية من هذه الفقرة"

## 10. Formulating questions

*'How did he decide to test the hypothesis? [She scrolls the page up] (00:31) [she scrolls the page down] what made the eleventh hypotheses none? < What is the reason that he repeated among all these factors? = [she scrolls the page down] >' (TA)*

"كيف انه قرر اختبار الفرضية؟ [انها تمرر الصفحة لأعلى] ( 00:31 ) [ أنها تمرر في الصفحة الى اسفل ]  
ماذا جعل الاحدى عشر فرضية لا شيء؟ > ما هو السبب الذي تكرر بين كل هذه العوامل؟ = [ أنها تمرر  
الصفحة الى الاسفل ] <"

*'I asked these questions because they motive me to try finding where are the answers for these questions (.) ahh I makes it easier for me to follow and comprehend the text' (SR)*

"سألت هذه الأسئلة لأنها الدافع لي لمحاولة إيجاد أين هي الإجابات عن هذه الأسئلة ( . ) آه أنها تجعل من السهل  
بالنسبة لي متابعة و فهم النص"

*'(00:12) ok when? These test \*\*\* produced? \*\*\* [she writes notes]' (TA)*

" ( 00:12 ) طيب متى؟ هذه التجربة \*\*\* انتجت؟ \*\*\* [انها تكتب ملاحظات]"

## 11. Making a summary

*'This information is very important I may use it in my assignments (.) I wrote summary for them so I can remember this information and return back to this article' (Ph2/SR)*

"هذه المعلومات مهمة جدا و يمكن أن استخدمها في مهامتي ( . ) لقد كتبت ملخص لهم حتى أستطيع أن أتذكر هذه  
المعلومات والعودة مرة أخرى إلى هذه المقالة"

## 12. Mentally visualising text content

*'I am reading this ahh what the researcher said to the patient here he wrote it as a quote is very important about their recovery process (.) also here is really good way that the researcher tried not to give the patient a hope that they will get full recovery to avoid any depression (.) also to avoid any emotional effect on the result this is good' (Ph2/TA)*

"أنا أقرأ هذا الخبر ما قال الباحث للمريض هنا وكتب على أنها إشارة مهم جدا حول عملية شفائهم ( . ) أيضا هنا هو حقا وسيلة جيدة أن الباحث حاول عدم اعطاء المريض اي امل في الحصول على الشفاء التام لتجنب أي اكتئاب ( . ) أيضا لتجنب أي تأثير عاطفي على النتيجة هذا أمر جيد"

*'Actually I have read these information and I was imagining the whole situation because of the style of the writer here he used a quotes of what he said to the patients (.) it is really exciting'* (Ph2/SR)

"في الواقع لقد قرأت هذه المعلومات ، وكنت أتخيل الوضع كله بسبب اسلوب الكاتب هنا انه استخدم ما قاله للمرضى ( . ) انه لمثير حقا"

*'I drew and I placed the information into points in a graph (.) it helps me to understand the information and remember it easily later on'* (SR)

"خطتت و وضعت هذه المعلومات في نقاط في رسم بياني ( . ) أنه يساعدي على فهم المعلومات و تذكرها بسهولة في وقت لاحق"

### 13. Continuing to read

*'Sometimes when I don't understand the abstract and I still interested in the paper I keep reading it because sometimes I understand when I complete reading but most of the time I lose my interest when I feel the article is too complicated from the beginning'* (Ph1/SR)

"أحيانا عندما لا أفهم الملخص و أنا لا ازال مهتمة في الورقة وأستمر في قرأتها لأن في بعض الأحيان أفهم عندما اكمل القراءة ولكن في معظم الأحيان أفقد اهتمامي عندما أشعر أن المادة معقدة للغاية من البداية"

### 14. Paraphrasing

*'Here I read these sentences needed to include them in my document (.) I wrote the beginning of the sentence but then I needed to check the idea (.) I returned to the article I re-read the idea and then typed them in the Word (.) I needed to check and remember the idea before paraphrasing and typing it ... .. I do this because I want to save my time when I start writing my assignment'* (Ph2/SR)

"هنا وأنا أقرأ هذه السطور كنت بحاجة إلى إدراجها في المستند ( . ) كتبت بداية الجملة ولكن بعد ذلك كنت بحاجة للتأكد من الفكرة ( . ) عدت إلى مقاله واعدت قراءة الفكرة و ثم كتبتها ( . ) كنت بحاجة لفحص و تذكر هذه الفكرة قبل إعادة صياغتها و كتابتها ..... أفعل هذا لأنني أريد أن أحفظ وقتي عندما أبدأ الكتابة "

## On-screen GLOB sub-strategies

### 1. Previewing

*'This is my first reading of this paper (.) I am only checking the information and the different parts of the study (.) I don't read in details anything (.) I only get the main idea of each part and then when I reread these parts for the second time I focus on the details'* (Ph2/SR)

"هذه هي القراءة الأولى لي لهذه الورقة ( . ) في هذه المحلّة من القراءة عادة اتحقّق من المعلومات و الأجزاء المختلفة من الدراسة فقط ( . ) أنا لا أقرأ تفاصيل أي شيء ( . ) أنا فقط أحاول الحصول على الفكرة الرئيسية لكل جزء ثم عندما أعيد قراءة هذه الأجزاء للمرة الثانية أركز على التفاصيل "

### 2. Skipping sections

*'Ok here I skipped the introduction part because all these are introductory information for the topic I don't need to read these now because I had an idea about this topic'* (Ph2/SR)

"طيب هنا أنا تخطيت جزء المقدمة لأن كل هذه هي معلومات تمهيدية للموضوع ولست بحاجة لقراءة هذه الآن لأنه كان لدي فكرة سابقة حول هذا الموضوع "

### 3. Having a purpose

*'I am searching about how the Saudi students in Saudi Arabia use the ecommerce (.) I found this paper about the ecommerce in Saudi Arabia (.) In this paper I was looking for case studies in this topic that I need to use in my assignment'* (Ph1/TA)

"أنا ابحث عن كيف الطلاب السعوديين في المملكة العربية السعودية يستخدمون *the ecommerce* ( . ) لقد وجدت هذه الورقة حول *the ecommerce* في المملكة العربية السعودية ( . ) في هذه الورقة كنت أبحث عن دراسة حالات في هذا الموضوع لأنني بحاجة لأستخدامها"

*'I chose this article because I want to talk about the stock market ahh in the GCC region (.) In general I want to see information about it therefore I downloaded this paper'* (SR)

"لقد اخترت هذا المقال لأنني أريد أن أتحدث عن *stock market ahh in the GCC region* في دول مجلس التعاون الخليجي ( . ) بشكل عام أريد أن أرى المعلومات حول هذا الموضوع ولذلك قمت بتحميل هذه الورقة "

#### 4. Attending selectively

*'To save my time (.) I don't have time to read everything in the paper (.) I need to be selective' (SR)*

"الحفظ وقتي ( . ) أنا لم يكن لدي الوقت لقراءة كل التفاصيل في هذه ورقة ( . ) أنا بحاجة أن اكون انتقائيه"

*'Because they are details and too much information (.) I don't need to read them (.) I am only looking for main ideas and main information, such as the definition of management system ahh and its basic criteria (.) I only focused on these three sections of the paper' (Ph1/SR)*

"لأنها تفاصيل ومعلومات كثيرة ( . ) ولست بحاجة لقراءتها ( . ) أنا ابحت هنا أنا اقرا وافهم عن الافكار والمعلومات الرئيسية فقط مثل تعريف management system ahh and its basic criteria ( . ) فقط اركز على هذه الاقسام من الورقة"

#### 5. Identifying main ideas

*'I was only checking the information and the different parts of the study (.) I don't read in details anything (.) I only get the main idea of each part and then when I reread these parts for the second time I focus on the details ... .. I do this because I do not want to waste my time reading everything and irrelevant information (.) you know I do not have time' (Ph2/SR)*

"كنت اتحرى المعلومات و أجزاء مختلفة من الدراسة ( . ) أنا لا احتاج ان أقرأ في تفاصيل أي شيء ( . ) أنا فقط اريد الحصول على الفكرة الرئيسية لكل جزء ثم عندما اعيد قراءة هذه الأجزاء للمرة الثانية أركز على التفاصيل ... .. أفعل هذا لأنني لا أريد أن أضيع وقتي في قراءة كل شيء، و معلومات غير ذات صلة ( . ) ليس لدي وقت "

*'Ok here I wrote notes that there is only a difference in COP in the all sample. Here I am writing down the main ideas only' (SR)*

"حسنا أنا هنا كتبت ملاحظات وافكار تشير الى انه هناك a difference in COP in the all sample أنا هنا كتبت الافكرة الاساسيه"

#### 6. 'Using text references

*'I found this citation (.) it is very relevant information to my topic (.) I needed to know the title of the paper (.) I searched for the article, download it and save it in one of the folder in my computer' (TA)*

"لقد وجدت هذا المصدر ( . ) من المعلومات ذات صلة بموضوعي ( . ) أنا في حاجة إلى معرفة عنوان الورقة ( . ) لقد بحثت عن هذه المقالة، وقمت بتحميلها وحفظها في واحدة من مجلداتي في جهاز الكمبيوتر الخاص بي"

## 7. Using background knowledge

*'Here I was thinking about the goal directed communication (.) actually I have read about this previously and I was thinking about that information and what are the connection between them (.) here they presented it differently' (Ph2/SR)*

"هنا كنت أفكر في *goal directed communication* ( . ) في الواقع لقد قرأت عن هذا من قبل، و كنت أفكر في تلك المعلومات وما هي العلاقة بينهما ( . ) هنا المعلومات قدمت بشكل مختلف"

## 8. Scanning

*'Ok here I was reading this paragraph fast because all these are details about the measurements (.) ahh (.) I am not focusing on this information at the moment (.) I only need to know which measurements that they used in the research' (Ph2/SR)*

"طيب هنا كنت أقرأ هذه الفقرة بسرعة لأن كل هذه هي تفاصيل حول القياسات ( . ) اه ( . ) أنا لا احتاج التركيز على هذه المعلومات في الوقت الراهن ( . ) ولست بحاجة لمعرفة القياسات التي استخدمت في البحث"

## 9. Locating key words

*'Ok here because this paragraph contained key words related to my focus (.) such as the acupuncture and the slimming effect (.) ahh I was focusing here and thinking about the information (.) these information are very important (.) ahh the first part was more literature review while this part here is very important information (.) ahh I was reading very slowly and I was trying to understand every single word' (Ph1/SR)*

"طيب هنا لأن هذه الفقرة تحتوي على كلمات رئيسية ذات صلة بهدفي ( . ) مثل *the acupuncture and the slimming effect* ( . ) أه كنت أركز هنا وأفكر في المعلومات ( . ) هذه المعلومات مهمة جدا ( . ) أه الجزء الأول كان أكثر مراجعة للمعلومات السابقة في حين أن هذا الجزء هنا يتكون من معلومات مهمة جدا ( . ) أه كنت أقرأ ببطء شديد و أحاول أن أفهم كل كلمة على حدى"

## 10. Using visual aids

*'They referred to a diagram and I moved the page down and here first I read the caption under the table and then I read the table, all these numbers (.). After that I moved the page down and read this diagram' (SR)*

"أشاروا إلى رسم تخطيطي و انتقلت الى اسفل الصفحة و هنا أولا قرأت *the caption under t table* من ثم قرأت الجدول ، كل هذه الأرقام ( . ) وبعد ذلك انتقلت إلى أسفل الصفحة وقرأت هذا المخطط "

## 11. Planning

*'Because this part here is a case study that I needed to include in my assignment (.). actually my reading now is just to select the related part (.). I mean the parts that I may use in my assignment and then I will reread them again' (Ph2/SR)*

"لأن هذا الجزء هنا هو دراسة الحالة التي كنت بحاجة إلى أن تدرج في كتابتي ( . ) في الواقع قراءتي الآن هو فقط لتحديد الجزء المتعلق بدراستي ( . ) أعني الأجزاء التي قد تستخدم في كتابتي وبعد ذلك سوف اعيد قراءة هذه الاجزاء مرة أخرى"

## 12. Connecting ideas

*'Here this idea was not clear actually I have read about this information before and they were contradicting the idea that I knew before (.). I reread it again and thought about it (.). actually I was thinking about this and the information that I have read before (.). I realized that I first understood it wrongly but after that when I reread it and I could understand what he means here' (Ph2/SR)*

"هنا كانت هذه الفكرة ليست واضحة في الواقع لقد قرأت عن هذه المعلومات قبل وكانوا يتعارضو مع هذه الفكرة ( . ) اعدت قراءتها مرة أخرى و فكرت في ذلك ( . ) في الواقع كنت أفكر في اللذي قرأته والمعلومات التي قرأتها من قبل ( . ) أدركت أنني أول الامر فهمت بشكل خاطئ ولكن بعد ذلك عندما اعدت القراءة تمكنت من فهم الفكرة"

## 13. Anticipating

*'Ok here I started reading the title and know about the authors of the article (.). the title here is a bit long actually when I read the title I thought about the information and the content of this article and in what ways it will help me in my assignment' (Ph1/SR)*

"طيب هنا بدأت أقرأ العنوان و معرفة كاتب المقالة ( . ) العنوان هنا طويل فعلا عندما قرأت العنوان فكرت في المعلومات و مضمون هذه المقالة وفي الطرق التي ستساعديني في كتابة بحثي"

*'Here I read the title ahh then (.) I stopped to think about its content and if it relates to my assignment (.) then I started to read the first paragraph' (Ph2/SR)*

"هنا قرأت عنوان الخبر ثم ( . ) توقفت للتفكير في محتواه و إذا كان يتعلق ببحثي ( . ) ثم بدأت في قراءة الفقرة الأولى"

#### 14. Pausing and thinking

*'I stopped my reading because I needed ahh I was trying to think and arrange the information. I was thinking about the characteristics of socially anxious people. Ahh I was explaining the information to myself in Arabic (.) this helps me to understand and remember the information' (SR)*

"توقفت عن القراءة لأنني احتجت ان افكر وارتب المعلومات. كنت أفكر في socially anxious people آه لقد شرحت المعلومات لنفسي باللغة العربية ( . ) وهذا يساعدي على فهم و تذكر المعلومات "

#### On-screen CRT sub-strategies

##### 1. Evaluating the information

*'Actually here I was thinking about their justification about choosing this sample size (.) ahh their justifications are quite good and why they choose this method and this period of time to conduct the study (.) they gave good justification for all these' (Ph2/SR)*

"في الواقع هنا كنت أفكر في مبرراتها حول اختيار حجم العينة ( . ) آه مبرراتها جيدة جدا ، ولماذا اختاروا هذه الطريقة و هذه الفترة من الوقت لإجراء الدراسة ( . ) أعطوا مبرر جيد لجميع هذه المعلومات"

##### 2. Evaluating the source

*'Because it is from association European society (.) it is well known but actually when I checked the date I checked it is out dated 2001 it is old' (Ph2/SR)*

"لأنه من association European society ( . ) أنه معروف جدا ولكن في الواقع عندما راجعت تاريخ المقالة وجدت انها قديمة 2001 "

### 3. Evaluating the language and the style

*'The language of this paper is not too difficult I could understand it easily but some of the paper I feel that they are really difficult and I need to reread the paper and translate a lot but this was simple and understandable'* (Ph2/SR)

"لغة هذه الورقة ليست صعبة للغاية و يمكن فهمها بسهولة ولكن بعض الاوراق العلمية أشعر أنها صعبة حقاً ، وأنا بحاجة إلى إعادة قراءتها و ترجمة الكثير ولكن هذه كانت بسيطة و مفهومه"

### 4. Evaluating the rhetorical structure

*'This paper is clear and easy to be read (.) ahh the structure of the sentences is clear (.) I could follow the paper easily (.) but in that paper I noticed the writers were repeating the information'* (Ph2/SR)

"هذه الورقة واضحة وسهلة في القراءة ( . ) آه بنية الجمل واضح ( . ) يمكنني أن اتتبع الورقة بسهولة ( . ) ولكن في تلك الورقة لاحظت الكاتب يكرر المعلومات "

### Reading as a whole: Strategic level of on-screen reading

#### Text level

*'After searching online to find relevant articles and read the suggested findings I read the abstract because the abstract contained mostly everything about the paper (.) if I found it interesting and if it contains good information I print it'* (Ph1/Intvw)

"بعد البحث على الانترنت للعثور على مقالات ذات صلة بهدفي اقرأ الملخص لأنه في الغالب يحتوي على كل شيء في الورقة ( . ) إذا وجدت أنها مثيرة للاهتمام و إذا كان يحتوي على معلومات جيدة اقوم بطباعتها "

*'At the beginning I search for papers relevant to my topic (.) ahh I read each option and choose between them'* (Intvw)

"في البداية كنت ابحث عن الأوراق ذات صلة بموضوعي ( . ) آه أنا أقرأ كل خيار وبعد ذلك اقوم بالاختيار بينهما"

*'I have read the title first and then checked that the title of the article is relevant to what I am looking for'* (Ph1/SR)

"لقد قرأت العنوان أولاً ثم تحققت من أن عنوان المقال ذات صلة بالذي أنا أبحث عنه"

*'I searched to find out about how Saudi students in Saudi Arabia use the ecommerce (.) I found the paper about ecommerce in Saudi Arabia (.) In this paper I was looking for case studies about the topic that I needed to use for my assignment'* (Ph2/SR)

"لقد بحثت لمعرفة المزيد عن كيف الطلاب السعوديين في المملكة العربية السعودية يستخدمو *the ecommerce* (. ) لقد وجدت ورقة حول *ecommerce* في المملكة العربية السعودية (. ) في هذه الورقة كنت أبحث عن حالات دراسية حول الموضوع الذي احتاجات ان اكتب عنه"

*'Actually I try to formulate an idea from the title and the abstract when I read online'*  
(Intvw)

"في الواقع أنا أحاول صياغة الفكرة الاساسية للمقاله من العنوان و الملخص عندما قرأت على الانترنت"

*'First (.) I only scanned the paper and only look for the most important parts in the article that means I am reading only to get an idea about the study'* (Intvw)

"أولا (. ) قمت بقراءة المقالة سريعا لايجاد الافكار الرئيسية و انظر فقط للأجزاء الأكثر أهمية في هذه الدراسة وهذا يعني أقرأ فقط للحصول على فكرة عامة عن الدراسة"

*'First of all I read the title and the abstract and then have a quick look at the whole article (.)I check its subtitles'*

"أولا وقبل كل شيء قرأت العنوان و الملخص ومن ثم القيت نظرة سريعة على المقالة بأكملها (. ) و تحققت من جميع اجزاءها"

*'The first reading is a quick reading'* (Intvw)

"القراءة الأولى هي قراءة سريعة"

*'I categorise the papers into groups on my laptop and in a hard copy folder according to what I need them for (.) for example those for writing introduction (.) and these for designing a device'* (Intvw)

"قمت بتصنيف الأوراق إلى مجموعات على جهاز الكمبيوتر المحمول و في مجلد مطبوع وفقا لما أنا في حاجة إليه (. ) على سبيل المثال تلك المجموعة لكتابة المقدمة (. ) و هذه لتصميم الجهاز"

*'First I collect around twenty articles related to one topic from Google scholar (.) and then I save them all in one file'* (Ph2/Intvw)

"أولا قمت بجمع نحو عشرين مقالة ذات صلة بموضوع واحد من محرك البحث جوجل (. ) وبعد ذلك حفظت كل منهم في ملف واحد"

*'I classify the papers in my files' (Ph2/Intvw)*

"قمت بتصنيف الأوراق في ملفات"

*'At the beginning I search for papers relevant to my topic (.) after that I export them to endnote which is my library where I categorise the papers into files and name all the files' (Intvw)*

"في البداية كنت ابحث عن الأوراق ذات صلة بموضوعي ( . ) بعد ذلك اقوم بوضعها في endnote وهو مكتبتي حيث اصنف الأوراق إلى ملفات واعطي اسم لكل ملف"

## Section level

*'The abstract is the first and the most important part of the paper that I read' (Ph1/Intvw)*

"الملخص هو أول و أهم جزء من الورقة التي قرأت"

*'I start reading the abstract and continue till the end of the paper' (Intvw)*

"أبدأ بقراءة الملخص و استمر حتى نهاية المقالة"

*'I start with the first part of the research article (.) which is the abstract (.) and the first part of the introduction to learn the writer's point of view' (Intvw)*

"أبدأ بالجزء الأول من هذه المقالة ( . ) والتي هي الملخص ( . ) والجزء الأول من المقدمة حتى اتعرف على وجهة نظر الكاتب"

*'Usually I don't read the introduction in most of the papers (.) I immediately read the methods' (Intvw)*

"عادة أنا لا أقرأ المقدمة في معظم المقالات ( . ) وعلى الفور اتجه الى قراءة طرق البحث"

*'She skips the introduction; she only had a quick look' (FN)*

"انها تتخطى المقدمة؛ انها فقط تلقي نظرة سريعة"

*'I start mainly with the methods then the other parts of the article' (Ph2/Intvw)*

"أبدأ أساسا بقراءة أساليب البحث ثم الأجزاء أخرى من المقالة "

*'First of all I read the title and the abstract and then quickly skim the whole article to check its subtitles' (Ph2/Intvw)*

"أولاً وقبل كل شيء اقرأ العنوان و الملخص ثم اقوم بقراءة ماتبقى من المقالة بسرعة حتى فقط اتحقق من اجزاءها المختلفة"

*'When I read the paper on-screen I usually read the title and the abstract then I highlight the most important sections that I need to read'* (Intvw)

"عندما اقرأ ورقة علمية على الشاشة عادة اقرأ العنوان و الملخص بعد ذلك اقوم بتسليط الضوء على أهم الأقسام التي انا بحاجة لقرائتها"

*'I never jump because when I jump I fear that I will understand something different from what the paper intended to present (.) so I read the abstract and then the introduction and understand what the research is about and the researcher's aim (.) who did it and then after understanding all this information (.) I continue reading the article (.) because if I read from the middle I don't know what they are talking about'* (Intvw)

"لا اقفز بين اجزاء المقالة لأنني عندما اقفز أخشى أن أفهم شيئاً مختلفاً عما هو في الورقة العلمية ( . ) ابدأ بقراءة الملخص والمقدمة واحاول ان افهم الهدف من الدراسه و هدف الباحث اللذي اجرى الدراسه ( . ) ( . ) أو اصل قراءة المقال ( . ) لأنه إذا قرأت من منتصف المقالة لا استطيع ان أعرف ما الذي يتحدثون عنه"

*'I start with the most important sections of the paper which is the abstract (.) then the hypothesis (.) result (.) and then the conclusion'* (Intvw)

"أبدأ بأهم أقسام الورقة والذي هو الملخص ( . ) ثم الفرضية ( . ) ثم النتيجة ( . ) ومن ثم الاستنتاج"

*'I don't read everything (.) I only read the abstract and then the conclusion and specific points in the middle'* (Intvw)

"أنا لا أقرأ كل شيء في المقالة ( . ) أقرأ الملخص ومن ثم الخاتمة و نقاط محددة في المنتصف"

*'I skipped the introduction part (.) because reading all the introductory information about the topic is not necessary for me because I have an idea about this topic (.) ahh... I wanted to read about the details of the study itself the methods and what they did'* (Ph1/SR)

"أنا تخطيت قراءة جزء المقدمة ( . ) لان قراءة كل المعلومات التمهيديّة حول الموضوع ليست ضروري بالنسبة لي لأن لدي فكرة عن هذا الموضوع مسبقاً ( . ) أه ... أردت أن أقرأ عن تفاصيل هذه الدراسة نفسها وأساليب البحث و ما فعلوه"

*'I used the bookmarks to choose the section that I wanted to read; that was where the hypothesis development was' (SR)*

"لقد استخدمت الإشارات المرجعية لاختيار القسم الذي أردت أن أقرأه ؛ كان ذلك عن فرضية البحث"

*'In my notes usually I write the outlines of some section' (Intvw)*

"في ملاحظاتي عادة أنا أكتب الخطوط العريضة لبعض أقسام المقالة"

*'When I finish a section I stop reading and rearrange my thoughts to integrate what I have learned and to think about that section (.) If it helps me and if it supports my research, or if it adds to my thinking and ideas and how? In this case, I review and reread the main points which prompted me to write notes' (Intvw)*

"عندما أنتهي من قسم أتوقف عن القراءة و اعيد ترتيب أفكاري لدمج ما تعلمته و للتفكير في هذا القسم ( . ) وإذا كانت المعلومات التي قرأتها تساعدني في بحثي و إذا كانت تدعم بحثي، أو إذا كان يضيف إلى تفكيري والأفكار ، وكيف ؟ في هذه الحالة ، اقوم بمراجعة و إعادة قراءة النقاط الرئيسية التي دفعتني لكتابة الملاحظات"

*'I was reading this section (.) it is about internet (.) it has linking ideas between the agriculture and the internet (.) ahh it is interesting and new information' (Ph1/SR)*

"كنت أقرأ هذا القسم ( . ) فهو عن الإنترنت ( . ) كنت اربط بين الأفكار بين الزراعة والإنترنت ( . ) آه انها معلومات مثيرة وجديدة"

*'I was connecting between these two sections here (.) ahh the data and the discussion' (SR)*

"كنت اربط بين هذين القسمين هنا ( . ) آه البيانات و المناقشة"

*'I was thinking about these two articles (.) only the methods (.) in this one they added interviews with the participants, while in this one they only performed an experiment' (SR)*

"كنت أفكر في هاتين المقالتين ( . ) فقط طرق البحث ( . ) في هذه أضافوا مقابلات مع المشاركين ، في حين أن هذه أدوا فقط تجربة"

## Paragraph level

*'I read the main idea of each paragraph' (Intvw)*

"قرأت الفكرة الرئيسية من كل فقرة"

*'I read the first three sentences of each paragraph and then I re-read them again and continue reading till its end' (Intvw)*

"قرأت الجمل الثلاث الأولى من كل فقرة ثم أعدت قراءتها من جديد وواصلت القراءة حتى النهاية"

*'Here this paragraph supports ideas in my research. Usually I put notes in Arabic. Sometimes I highlight the entire paragraph if I am going to use the same sentences in my writing' (Intvw)*

"هنا هذه الفقرة تدعم الأفكار في بحثي . عادة أضع الملاحظات باللغة العربية. أحيانا اقوم بتسليط الضوء على الفقرة بأكملها إذ اردت انا استخدام نفس الجمل في كتاباتي"

*'I stopped here (.) I was thinking about the meaning of this paragraph as a whole and its ideas' (SR)*

"توقفت هنا ( . ) كنت أفكر في معنى هذه الفقرة ككل و أفكارها"

*'Here I read this paragraph to the end but I needed to re-read it to extract the main ideas' (Ph2/SR)*

"هنا قرأت هذه الفقرة إلى نهاية ولكن كنت بحاجة إلى إعادة القراءة لاستخراج الأفكار الرئيسية"

*'I read this paragraph and then I realised that this part related to the previous one (.) I needed to reread the previous paragraph again to remember the information and then make a connection between the ideas' (Ph1/SR)*

"قرأت هذه الفقرة ومن ثم أدركت أن هذا الجزء ذات الصلة بسابقتها ( . ) كنت بحاجة لإعادة قراءة الفقرة السابقة مرة أخرى لتذكر المعلومات و ثم إجراء ربط المعلومات"

*'Ok here I saw this table but I could not understand it I needed to return to, and reread, the paragraphs that preceded it to understand it (.) that is why I moved the page up and down here (.) I read this information the first time, but I needed to re-read it again, not because it was difficult but because it was full of details' (Ph2/SR)*

"طيب هنا رأيت هذا الجدول ولكن ام أستطيع أن أفهم ذلك كنت بحاجة للعودة، وإعادة القراءة ، و الفقرات التي سبقتها حتى اتمكن من فهمها ( . ) وهذا هو السبب في أنني انتقلت بين الصفحات صعودا وهبوطا ( . ) هذه اول مره اقوم بقراءة هذه المعلومات ، ولكن كنت بحاجة لإعادة قراءتها ، ليس لأنه كان من الصعب فهمها ولكن لأنها كانت مليئة بالتفاصيل"

## Sentence, phase and word levels

*'Here with these sentences, as you can see I was reading very slowly because I needed to concentrate very hard (.) I was reading the numbers (.) actually here I needed to slow down my reading because these numbers are confusing' (SR)*

"هنا مع هذه الجمل ، كما ترين كنت أقرأ ببطء شديد لأنني بحاجة إلى التركيز الشديد ( . ) كنت أقرأ الأرقام ( . ) في الواقع هنا أنا في حاجة لإبطاء قراءتي لأن هذه الأرقام مربكة"

*'Okay, I tried to focus on the key words here to get a quick idea about the paragraph' (SR)*

"حسنًا، أنا حاولت التركيز هنا على الكلمات الرئيسية للحصول على فكرة سريعة وشاملة عن الفقرة"

*'I was reading and I was picking up the key words (.) for example empirically examine and developing countries' (SR)*

"كنت أقرأ واحاول ان التقط الكلمات الرئيسية ( . ) على سبيل المثال empirically examine and developing countries"

*'Actually here I could not understand these sentences (.) they are really complicated (.) actually I ignored them' (Ph1/TA)*

"في الواقع هنا لم أستطيع أن أفهم هذه الجمل ( . ) إنها معقدة حقًا ( . ) في الواقع تجاهلها"

*'I ignored it at the end, what should I do? I re-read the sentence many times but I could not understand the words' (SR)*

"تجاهلتها في النهاية، ماذا علي أن أفعل؟ أعدت قراءة الجملة عدة مرات ولكن لم أستطيع أن أفهم العبارة"

*'I read the first sentence of the results section but I needed to re-read it because I did not understand' (SR)*

"قرأت الجملة الأولى من جزء النتائج ولكن كنت بحاجة إلى إعادة القراءة لأنني لم أفهم"

*'Here I was reading these sentences (.) actually I re-read them several times' (SR)*

"هنا كنت أقرأ هذه الجمل ( . ) في الواقع أعدت قراءتها لعدة مرات حتى أفهم"

*'Demographic data ok [she scrolls the page down] (00:25) [she scrolls the page down] (00:45) ok this is good for the patient [she scrolls the page down] (00:32) [she scrolls the page down] ok what here? How they did the transcript go? (01:22) [she scrolls the*

*page down] (00:31) [she scrolls the page up] (00:45) I need to re-read this [she scrolls the pages down slowly] (01:46)' (TA)*

*Demographic data* طيب [ أنها تحرك الصفحة الى الاسفل ] ( 00:25 ) [ أنها تحرك الصفحة الى الاسفل ] ( 00:45 ) حسنا هذا أمر جيد بالنسبة للمريض [ أنها تحرك الصفحة الى الاسفل ] ( 00:32 ) [ أنها تحرك الصفحة الى الاسفل ] طيب ماذا هنا ؟ كيف *the transcript go* ؟ ( 01:22 ) [ أنها تحرك الصفحة الى الاسفل ] ( 00:31 ) [ انها تمرر الصفحة لأعلى ] ( 00:45 ) انا بحاجة لاعادة قراءة هذا [ أنها تحرك الصفحة الى الاسفل ببطء ] ( 01:46 )"

*'I highlighted this word because I wanted to translate it' (SR)*

"لقد قمت بتظليل هذه الكلمة لأنني أردت أن اترجمها"

*'I highlighted these sentences (.) to focus on the experiment (.) also I reread them' (SR)*

"قمت بتظليل هذه الجمل ( . ) للتركيز على التجربة ( . ) أنا أيضا اعدت قرأتها"

*'Everything that I read I analyse in my mind for example when I read I translate into Arabic in my mind to get the meaning (.) I imagine the sentence in Arabic and try to understand what the writer means in Arabic' (Ph1/Intvw)*

"كل شي اقرأه اقوم بتحليله في ذهني على سبيل المثال عندما اقرأ أترجم إلى العربية في ذهني للحصول على المعنى ( . ) أتصور أن الجملة في اللغة العربية و احاول فهمها باللغة العربية"

*'I was pointing to concentrate on these sentences (.) these are very important and complicated sentences' (Ph2/SR)*

"كنت أؤشر حتى اتمكن من التركيز على هذه الجمل ( . ) وهذه الجمل هامة جدا ومعقدة"

*'I used the cursor here to focus reading on these sentences' (SR)*

"استخدمت المؤشر هنا للتركيز على قراءة هذه الجمل "

*'First I read it and I read it again (.) ahh I translate the difficult words' (Ph1/Intvw)*

"أولا أقرأ و ثم اعيد القراءه مرة أخرى ( . ) و اترجم الكلمات الصعبة"

*'I was trying to understand the word consistently from the context. I was thinking about what this word means here. Actually I did not understand' (SR)*

"كنت أحاول أن أفهم كلم *consistently* من *context* . كنت أفكر في ما تعنيه هذه الكلمة هنا . في الواقع لم أستطع ان أفهم"

*'I was checking the meaning and pronunciation of the word appetitive. I used Google to listen and learn the meaning. Then I had to reread the sentence' (SR)*

"كنت أتأكد من المعنى و نطق الكلمة *appetitive* استخدمت *Google* لاستمع و اعرف المعنى . ثم اضطررت إلى إعادة قراءة الجملة "

*'If there are important points in the paper I copy and paste them into my schedule and I create a tag for them to see where I can use them in my writing when I write my report (.) for example (.) this section is about the problems with spurges (.) so I wrote here spurge problems and I made tag for it and I made a tag for these sentences but it is the same copied and pasted. I do not paraphrase until I start writing' (Intvw)*

"إذا كانت هناك نقطة مهمة في الورقة العلمية اقوم بطباعتها ولصقتها في مذكرتي وأضع علامة لهم لأحدد أين أين يمكنني استخدامها في عندما أكتب تقريرتي ( . ) على سبيل المثال ( . ) هذا القسم هو عن المشاكل مع *spurges* ( . ) لذلك كتبت هنا *spurge problems* و جعلت علامة لذلك ، وضعت شعارا لهذه الجمل ولكنه هو نفسه نسخ ولصق . أنا لا اعيد صياغة الجمل حتى أبدأ الكتابة"

*'If I am going to use specific information from a text in my writing (.) I directly paraphrase them from the article into my report' (Intvw)*

"إذا كنت اريد ان استخدم معلومات محده من المقال كتاباتي ( . ) اقوم بصياغة الجملة صياغة مباشرة من المقالة إلى تقريرتي"

*'If it is interesting and contains something relevant to my project (.) I print it and then I read it in details from the printed copy' (Intvw)*

"أذا كانت المعلومات مهمة ومثيرة تحتوي على شيء ذي صلة بمشروعي ( . ) اقوم بطباعتها ثم أقرأها بالفصيل من النسخة المطبوعة"

*'Usually I print the paper if needed to re-read it in more detail' (Intvw)*

"عادة عندما أترجم أي كلمة أفكر في معنى أن أكون قد حصلت على و معنى الجملة و محاولة لتناسب معنى تلك الكلمة مع الجملة بالكامل"

## J.5 Field notes - Sample

### On-screen reading

My Comments	My Questions
She started to read the paper and giving the reason for choosing this article. She did not read the abstract carefully I think she read the article before.	What is the first thing that you did after downloading this paper at home?
She is skipping many paragraphs.	Why did you skip the introduction?
She is reading with her eyes most of the time.	What were you doing here (06:23)?
She is using her finger and the cursor to point on the sentences in specific instances while she is reading.	What were you doing here (11:48) why you were pointing with your finger?
She opened the folder from her USB and searched in the saved articles.	Here why did you open research articles from your folder?
She is reading and thinking here with loud voice.	Why were you talking here with loud voice about the information (20:46)?
She skipped the abstract from the paper that she opened from her folder.	Why did you skip the abstract here (23:21)
Once the paper opened on screen, she closed the bookmarks.	Why did you close the Bookmarks which is at the side of the screen (18:57)?
She minimizes the size of the article on the screen then she reads.	Why did you minimize the size of the articles on the screen?
She highlights specific sentences while she is reading	Why did you highlight these?
This is the first time that she translate a word	Why did you translate this word (25:18)?
Her reading is connected to the writing process	When you read onscreen, do you usually read and write immediately or you read and then read again and write?

(Continue overleaf)



**Final Comment:**

- Her onscreen reading includes several tasks such as reading, searching on the web, and searching in her existing folder, looking for references, linking ideas, and writing.
- She seems familiar and comfortable with onscreen reading.
- Her onscreen reading is not a focused reading; it is more skimming and scanning for specific information.
- Her onscreen reading is more connected to the writing process. She reads and writes.
- She is searching and reading specific points.
- When she was reading onscreen, she had several open windows. Sometimes I feel that she is confused between them. Sometimes she needs to view them all to find the one that she wants.
- She translates the words into Arabic using Google translator.
- She translated a word Corporal. Although the word has its definition in the paper, she copy used Google translator to get the Arabic meaning
- She is taking an overview of the paper. She is checking what is relevant and what is not
- She was using page up and page down to move between the pages
- Most of the time her reading was skimming
- In only 15 minutes she opened three articles and had a quick look at them. Her plan was to read only one but being online direct her to read other papers.
- She seems that she is not very comfortable with screen reading (.) when she reads she first realize that there is difficult word, she opens Google translator, then she return to the page to copy the word, then she return to the Google translator to past the word and get the meaning.
- Whenever she found difficult word, she directly translates it. Again here I think if she completed reading the sentences she might understand the meaning of the word and may not need to translate it
- She reads silently, most of the time she follows the sentences with her eyes.
- Near the end of the observation, she does not seem very familiar with onscreen reading.
- She is not reading carefully, although she seems that she is trying to focus, but she is not.
- I think she use the computer to search for the information more than for reading.

## J.6 Data From a Master's Student - Sample

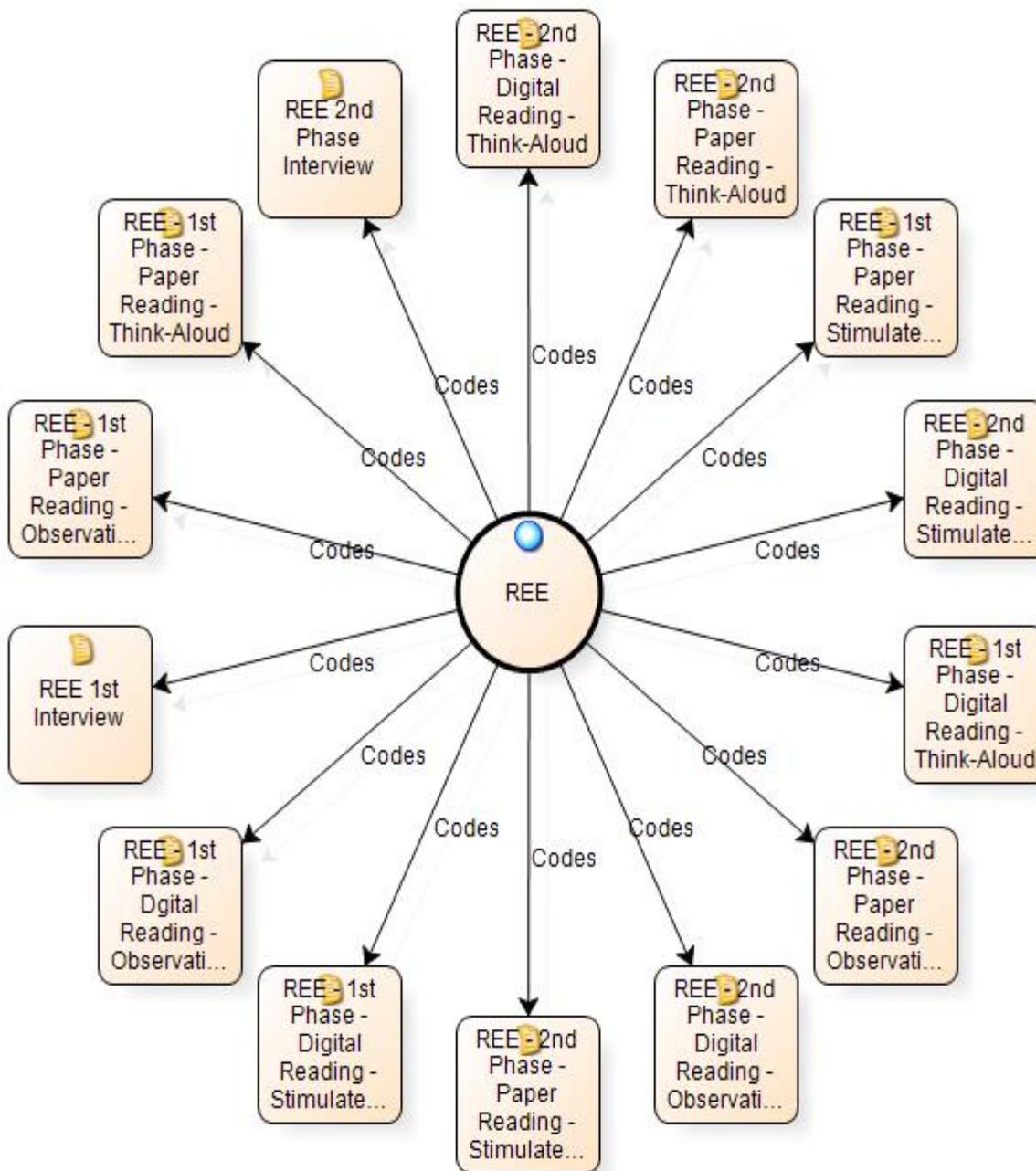


Figure 34: Data from a Master's student - Sample

## J.7 Data From a PhD Student - Sample

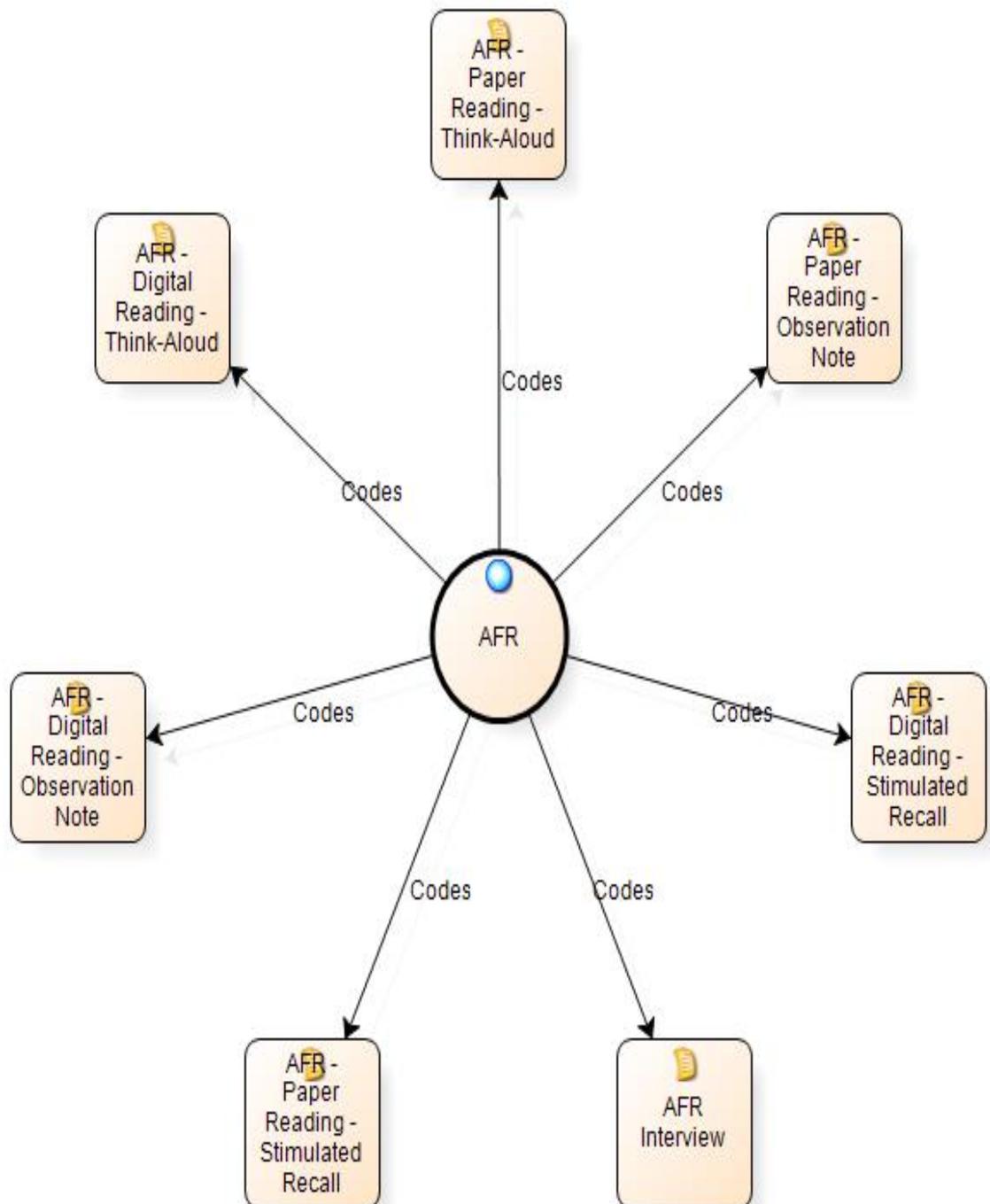


Figure 35: Data from a PhD student - Sample

## J.8 NVivo Data - Sample

The screenshot shows the NVivo software interface. The main window displays a table titled 'Codes - Themes'. The table has the following columns: Name, Sources, References, Created On, Created By, Modified On, and Modified By. A red oval is drawn around the 'References' column. The table lists various reading strategies and their associated source and reference counts.

Name	Sources	References	Created On	Created By	Modified On	Modified By
Ignoring difficult parts	9	10	27/10/2014 11:32	HANADI	23/07/2014 14:41	HANADI
Imagining the whole situation	2	2	27/10/2014 11:32	HANADI	04/04/2014 12:52	HANADI
Keywords	18	38	27/10/2014 11:32	HANADI	24/07/2014 13:54	HANADI
Planning	6	13	27/10/2014 11:32	HANADI	23/07/2014 19:49	HANADI
Previewing	39	97	27/10/2014 11:32	HANADI	24/07/2014 12:05	HANADI
Reading and Thinking	45	114	27/10/2014 11:32	HANADI	15/08/2014 16:41	HANADI
Scanning	5	12	27/10/2014 11:32	HANADI	04/04/2014 12:52	HANADI
Skipping	43	92	27/10/2014 11:32	HANADI	24/07/2014 14:18	HANADI
Using background knowledge	16	26	27/10/2014 11:32	HANADI	24/07/2014 12:17	HANADI
Using visual aids	19	32	27/10/2014 11:32	HANADI	24/07/2014 14:29	HANADI
<b>Problem Solving Reading Strategies</b>	<b>83</b>	<b>1145</b>	27/10/2014 11:32	HANADI	03/11/2014 18:05	HANADI
Electronic Translation	36	76	27/10/2014 11:32	HANADI	30/09/2014 15:40	HANADI
Grammar	0	0	27/10/2014 11:32	HANADI	06/11/2013 15:42	HANADI
Handcopies Translation	0	0	27/10/2014 11:32	HANADI	06/11/2013 15:40	HANADI
Ideas mapping tools	3	3	27/10/2014 11:32	HANADI	24/07/2014 11:54	HANADI
Pausing	40	148	27/10/2014 11:32	HANADI	17/08/2014 14:56	HANADI
Pointing	69	304	27/10/2014 11:32	HANADI	17/08/2014 14:56	HANADI
Reading and Thinking	45	114	27/10/2014 11:32	HANADI	17/08/2014 14:56	HANADI
Reading rate	17	31	27/10/2014 11:32	HANADI	24/07/2014 14:11	HANADI
Rereading	55	226	27/10/2014 11:32	HANADI	24/07/2014 14:26	HANADI
Using context	7	8	27/10/2014 11:32	HANADI	24/07/2014 12:25	HANADI
<b>Support Reading Strategies</b>	<b>85</b>	<b>2675</b>	27/10/2014 11:32	HANADI	03/11/2014 18:05	HANADI
Changing reading position	10	14	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Confirmation	37	245	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Connecting ideas	32	76	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Digital activities	8	53	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Electronic Vocalization	5	8	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Formulate question	25	55	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Ignoring difficult parts	9	10	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Keep Reading	2	4	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Making summary	27	38	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Marking the text	67	428	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Paraphrasing	3	6	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Pausing	40	148	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Personal Vocalization	41	204	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Pointing	69	304	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Reading Writing	23	65	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Reviewing	24	41	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI
Separating sections	4	6	27/10/2014 11:32	HANADI	03/11/2014 18:02	HANADI

Figure 36: Quantitative data analysis - Sample

## J.9 NVivo Data - Sample

The screenshot displays the NVivo software interface. The top menu bar includes File, Home, Create, External Data, Analyze, Query, Explore, Layout, and View. Below the menu is a ribbon with various toolbars for workspace, item, clipboard, format, paragraph, styles, editing, and proofing. The left sidebar shows a tree view of nodes, including 'All participants (All data)', 'Codes - Themes', 'Master Participants', 'Modes of Data', 'PhD Participants', 'Topics', 'Relationships', and 'Node Matrices'. The main window is titled 'Codes - Themes' and contains a table with columns: Name, Sources, References, Created On, Created By, Modified On, and Modified By. A red circle highlights a text segment in the main window, which is a quote from a participant discussing reading a diagram and linking information.

Name	Sources	References	Created On	Created By	Modified On	Modified By
Ignoring difficult parts	9	10	27/10/2014 11:32	HANADI	23/07/2014 14:41	HANADI
Imagining the whole situation	2	2	27/10/2014 11:32	HANADI	04/04/2014 12:52	HANADI
Keywords	10	38	27/10/2014 11:32	HANADI	24/07/2014 13:54	HANADI
Planning	6	13	27/10/2014 11:32	HANADI	23/07/2014 18:49	HANADI
Processing	39	97	27/10/2014 11:32	HANADI	24/07/2014 12:05	HANADI

Reference 1 - 4.80% Coverage

They referred to a diagram and I moved the page down and here first I read the caption under the table and then I read the table, all these numbers. After that I moved the page down and read this diagram. Actually here I was reading the information in the diagram and I was thinking about linking the information together and compare between the different groups.

Reference 1 - 3.79% Coverage

**Why were you pausing?**  
Usually when I read I need to stop for a while to think about what I have read (.) this helps me to understand and remember the information later on.

**What do you do when you think about the information?**  
I try to connect the ideas together also I try to remember if I read information related to this so I can remember it and connect it to what I am reading.

Reference 2 - 3.38% Coverage

**Why did you pause here with these information (03:58)?**  
Simulation and geographic information (.) ahh I have read about them before I was connecting between them and the written information here (.) when I observed them I reread the sentences that preceding them because here they presented them as an example (.) it refreshes my information.

Reference 3 - 3.21% Coverage

**What were you doing here with the diagram (05:21)?**

Figure 37: Qualitative data analysis - Sample

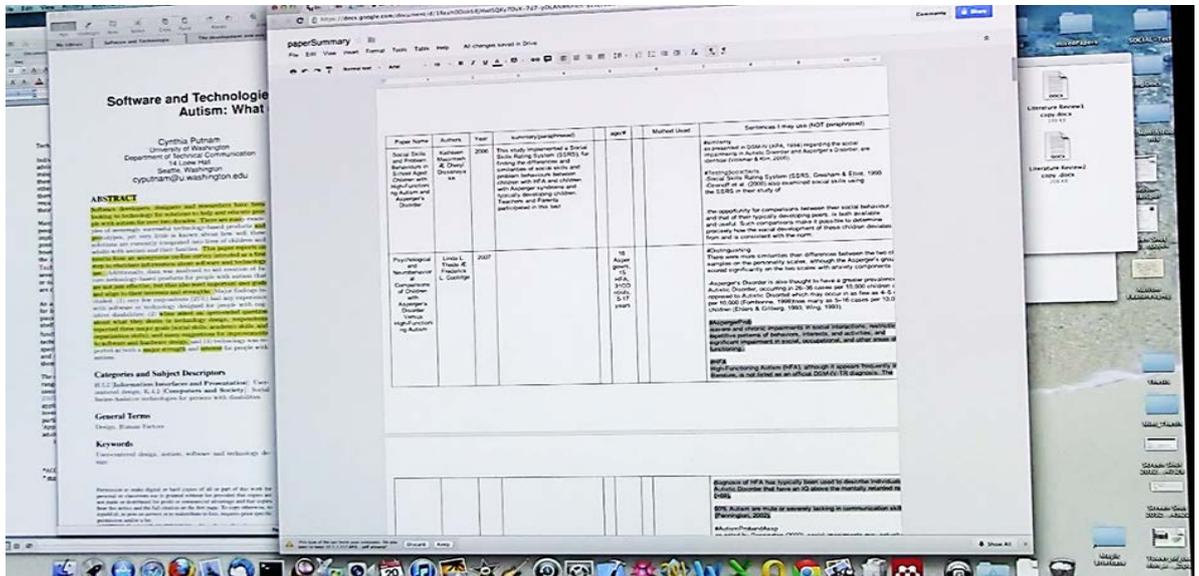
## J.10 Excel Data - Sample

Support-reading strategies	Marking the text	Making summary	Taking notes	Personal Vocalization	Electronic Vocalization	Formulate question	Paraphrasing	Changing reading position	Confirmation	Connecting ideas	Pausing	Reading Writing	Reviewing	Using the reference	Separating sections	Pointing	Ignoring difficult parts	Keep Reading
1 : SAJ	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0
2 : REE	1	0	1	1	0	0	0	1	1	1	1	0	1	1	0	1	0	0
3 : MAH	1	1	1	0	0	1	0	1	1	1	1	0	1	1	1	1	1	0
4 : AML	1	1	1	1	0	1	0	1	1	1	1	5	0	1	0	1	0	0
5 : LAM	1	1	1	1	0	0	1	1	1	1	1	4	1	0	1	1	0	0
6 : RER	1	1	1	1	0	1	0	1	1	1	1	0	0	1	0	1	0	0
7 : ARE	1	1	1	1	0	1	0	0	1	1	1	0	1	0	1	1	0	0
8 : ALA	1	1	1	1	0	1	0	1	1	1	1	0	0	1	0	1	1	0
9 : FAT	1	1	1	1	0	0	0	1	1	1	1	0	1	1	0	1	0	0
10 : EMA	1	1	1	1	0	1	0	1	1	1	1	0	0	0	1	1	0	0
11 : DAL	1	0	1	1	0	1	1	1	1	1	1	1	0	1	0	1	0	0
12 : AFR	1	1	1	1	0	1	0	1	1	1	1	0	1	0	0	1	0	0
13 : GAD	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0
14 : LAI	1	0	1	1	0	1	0	1	1	1	1	3	1	0	1	1	0	0
15 : HEN	1	1	1	1	0	0	1	1	1	1	1	0	1	0	1	1	0	0
16 : MAJ	1	1	1	1	0	1	0	1	1	1	1	0	1	1	1	1	0	0
17 : SAR	1	1	1	1	0	1	0	1	1	1	1	0	0	0	0	1	1	0
18 : BDR	1	1	1	1	0	1	0	0	1	1	1	0	0	1	0	1	0	0
19 : RSH	1	1	1	1	0	0	0	1	1	1	1	0	0	0	1	1	0	0
20 : FAF	1	0	1	1	0	1	1	0	1	1	1	0	1	1	0	1	0	0
Total	20	16	20	18	1	14	6	17	20	20	20	14	11	12	10	20	4	0

Table 17: Quantitative data analysis - number of reading strategy users - Sample

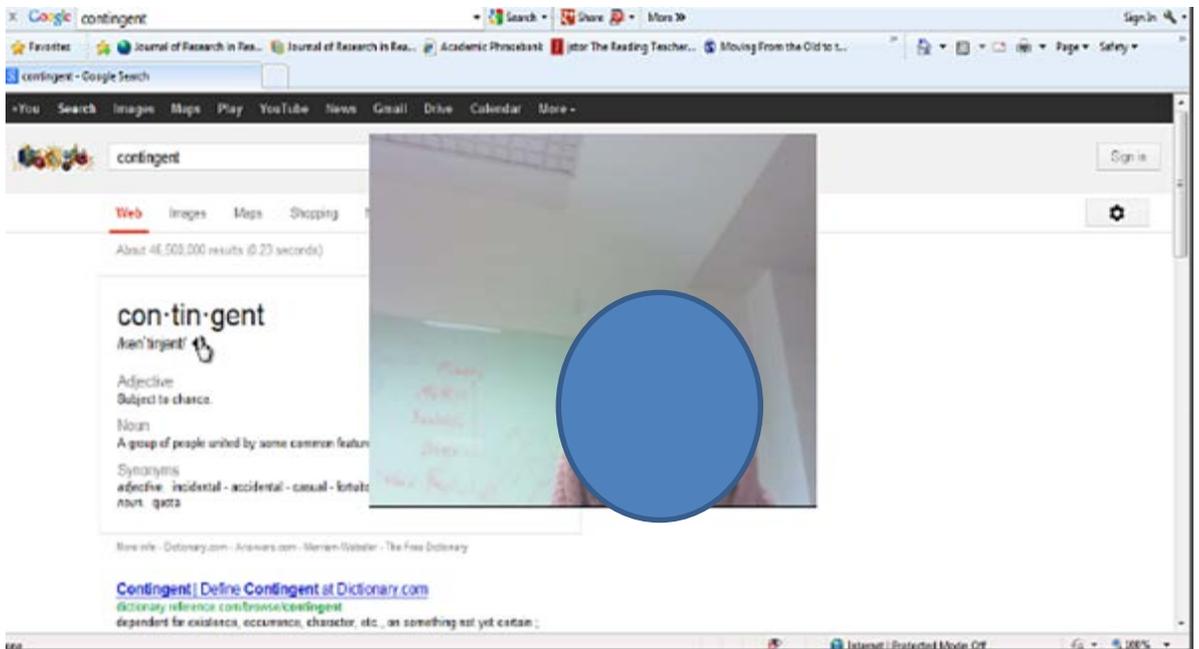
# Appendix K Pictures

## K.1 Picture 1



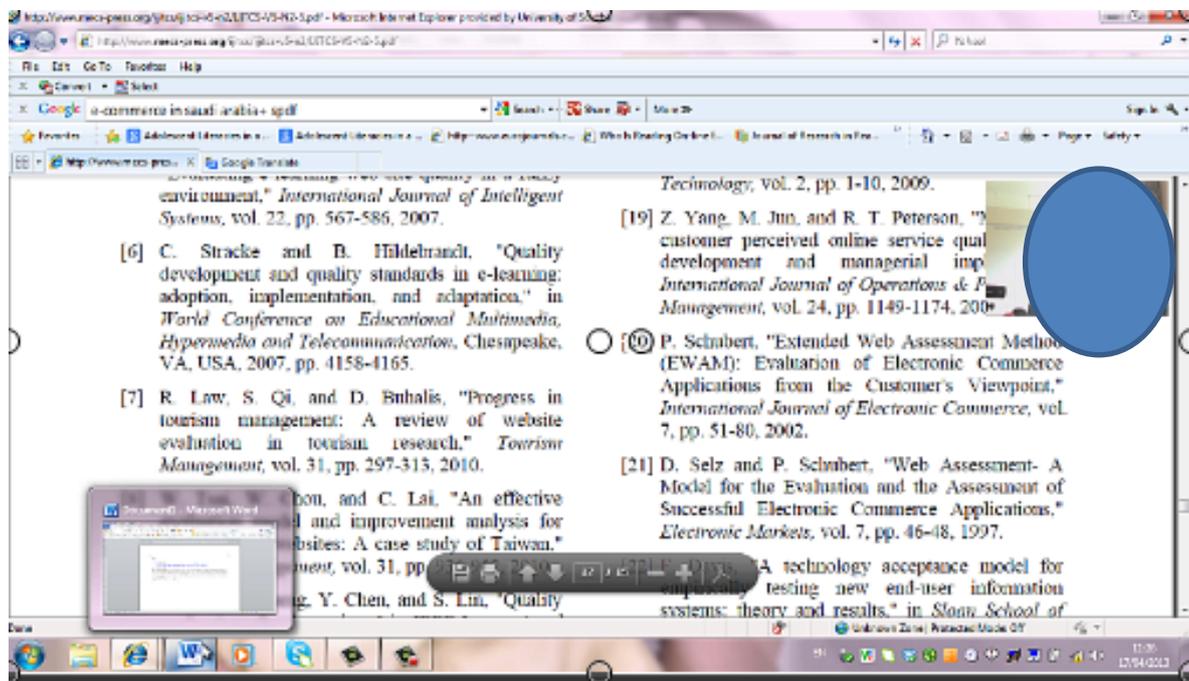
Picture 1: Juxtaposing

## K.2 Picture 2



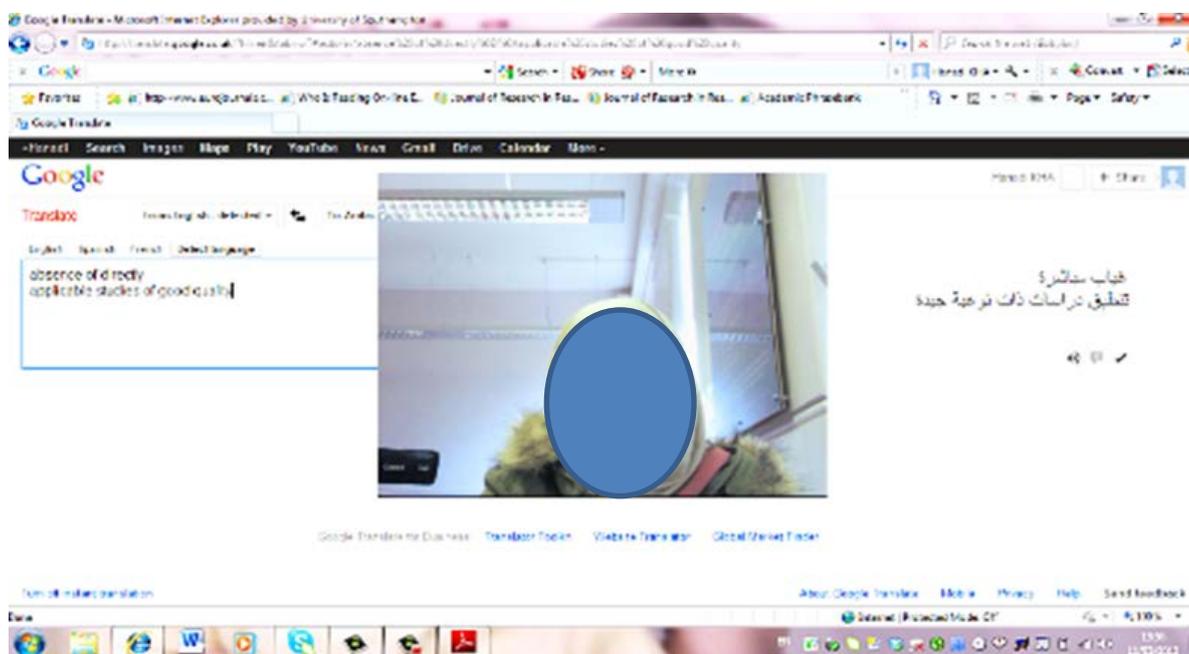
Picture 2: Vocalising electronically

### K.3 Picture 3



Picture 3: Reading Writing

### K.4 Picture 4



Picture 4: Using Google translate

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