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An Investigative Study of English Vocabulary Acquisition Patterns in Adult L2 Tertiary Learners with Chinese/Malay L1

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

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Abstract

This study investigates patterns of second language (L2) learners' vocabulary acquisition of English in pedagogical contexts, and develops a vocabulary acquisition model, specifically a pre-receptive to productive vocabulary (PR-PV) model which analyses the patterns of inferencing strategies, the role of context on the strategies, and the influence of teaching explicit strategies on vocabulary development. Research in the area of vocabulary development is unclear on the interrelationships among various aspects of lexical competence, learning, and production processes in second language lexical acquisition. Models of vocabulary acquisition in English as a second language are scarce and the lack often prompts L2 researchers to draw from first language vocabulary study models to correlate vocabulary developmental patterns. Research is also uncertain about how L2 learners respond to reading texts however, it is quite clear that the receptive vocabulary of L2 learners is larger than productive vocabulary.

The study employed a mixed-method research approach and the findings suggest that both content and context play significant roles in the extent to which L2 learners interact efficiently with reading texts. The findings from the study may have pedagogical and theoretical implications for curriculum developers, instructors and policy makers in second language tertiary English learning contexts.

Acknowledgements

Dedication

This thesis is dedicated to my beloved daughters, Sharanya and Chaithanya and my loving husband Giri.

Preface

I was inspired to complete my doctoral studies on vocabulary development in second language learners (L2) of English owing to a number of factors. I was disappointed not to have availed of an opportunity for a scholarship to Birmingham University to complete a PhD in Applied Linguistics soon after I had completed a Master's Degree in India. I had to set aside my higher studies ambitions then. Soon after, I enjoyed a short stint of teaching at a university before finding myself in matrimonial bliss through traditional Hindu wedding customs. I then moved to Malaysia with my husband and found myself marveling at the use of terminologies and language adoptions in the local language Malay. There was no doubt that Sanskrit the ancient Indo-European language had had some linguistic influences on the Malay language along with a host of other languages including English. My interest in vocabulary development in English among L2 learners was further stimulated when I started reading to my baby daughter and understanding how reading and learning words resonated with her. My happiness had no bounds when she could read at the age of two. I was an experienced hand at teaching reading to small children when my second daughter was born and "experimental studies" on reading and vocabulary development continued at home. Visits to the only library on the idyllic island of Labuan in Malaysia had often elated all three of us. Then an opportunity presented itself for teaching at university. After a hiatus and career break, I once again found myself drawn to the way L2 learners developed vocabulary at tertiary levels. With requests from my students we experimented with numerous vocabulary learning activities. There were rewarding moments when etymological vocabulary teaching approaches found effective results and anecdotal accounts by students pointed to positive changes. I knew then my dream of being an expert on vocabulary development in L2 learners need not remain latent. Pilot studies followed and I soon took the route taken by countless academics before me to complete a doctoral degree.

Through this thesis, I have developed a vocabulary learning and development model for L2 tertiary learners of English. The aim of the thesis is to investigate vocabulary development patterns in tertiary L2 learners and develop an L2 vocabulary learning model. I hope that through this study, critical gaps in L2 vocabulary learning will be filled. The thesis represents a culmination of research studies carried out between 2004-2010. It represents the overcoming of many challenges, that of balancing life between work, study and home. Needless to say, any errors of fact and opinions are the sole responsibility of the author.

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Chapter 1- Introduction

This thesis investigates patterns of English vocabulary inferencing strategies in second language (L2) learners occurring between pre-receptive stages to productive processes for vocabulary development in pedagogical contexts, and examines whether explicit instruction of inferencing and vocabulary learning strategies advance vocabulary development. Experimental and statistical studies in applied linguistics have identified lexical knowledge as the most perceptible aspect of the learners' capacity to read and understand texts (Nation & Coady, 1988). More recent research in second language vocabulary studies (Read, 2007; Pulido & Hambrick, 2008) further confirm the links between second language reading comprehension and vocabulary knowledge. Cognitive studies and psycholinguistics studies have focussed on the roles of vocabulary knowledge in language learning and reading comprehension, and an increased breadth and depth of vocabulary are believed to increase comprehension and language learning considerably (Qian, 1999; Hirsch, 2003). During reading, the L2 learner is said to apply a series of cognitive processes or strategies to draw inferences from context to create meaning. Inferencing has been accepted as an underlying cognitive process in reading comprehension (Anderson & Pearson, 1984; Graesser & Bower, 1990, Kintsch, 1988, Monzo & Calvo, 2002; Bengeleil & Paribakth, 2004).

Inferencing is a well established concept in literature on reading comprehension and some researchers have made distinctions in the way learners approach inferencing. Inferencing is a cognitive process that occurs during reading through which it is assumed that L2 learners build upon existing knowledge through drawing representations of logical properties of words and sentences. In order to achieve successful inferencing, L2 learners may use analytical references or thematic references, and use interlinks developed between L1 and L2 cognates to facilitate knowledge transfer for comprehension and vocabulary development. In lexical inferencing, the

learner attempts to make informed assumptions of the meanings of word using linguistic cues available in context, and additionally uses domain knowledge and various forms of knowledge of the text (Haastrup 1991). However, few studies have focussed on the inferencing strategies specifically employed by L2 learners in a tertiary setting or on whether the explicit teaching of effective vocabulary strategies benefits learners in advancing vocabulary development. The existing body of research in L2 vocabulary acquisition focuses almost exclusively on what is learned and not how it is learned (Carter & McCarthy, 1999).

1.1 Relevance of Tertiary Settings for Adult L2 Learners

Comparatively little is known about how adult L2 learners adapt lexical and inferencing strategies during reading in tertiary environments where learning is socially constructed in shared learning environments and there is increased interaction between learners themselves and between learners and instructors. There is a need to focus on tertiary L2 learners as they learn and use language at an academic level that is qualitatively different to other registers of use. Studies such as those by Ahmad (1989) on the use of vocabulary strategies have shown that there are variations in the way learners use strategies. Active strategy users, described as those who had a greater awareness of strategies and had taken steps to adapt strategies according to appropriateness, were found to be more successful, whereas poor learners who had minimal awareness often experienced poor knowledge of word learning (Ahmed, 1989; Sanaoui, 1995). Other studies, such as those by (Waring, 1999), propose that learners' knowledge of words may be mediated during the mental processes of receiving and producing language. These observations call for closer examination and clarification. In this thesis, the basis for lexical representation was examined by exploring the issues of acquisition within English as a second language pedagogical paradigm. In addition, it examined vocabulary development by looking at the effects of explicit teaching on word production.

The intention of this research is to provide fundamental data on the various strategies employed by adult tertiary L2 learners for comprehension of receptive vocabulary, and on the processes that are involved in converting receptive vocabulary knowledge to productive vocabulary in the learners' mental lexicon. The learners'

mental lexicon can be defined as an accumulated storage of language users' words, their meaning and forms which are essentially shared between the production and comprehension systems similar to grammatical and phonological knowledge (Psycholinguistics An Overview, 1992).

Currently, researchers of L2 vocabulary acquisition are almost silent on the roles of innate mechanisms initiated as a response to strategies employed by ==adult tertiary== L2 learners in achieving productive vocabulary. There is a strong call for vocabulary proficiency to be assessed and evaluated contextually, (Waring; 2003; Read 2007) given the significance of lexical inferencing in reading comprehension. Thus it was seen as important to investigate vocabulary development patterns in L2 learners in tertiary academic settings and examine whether explicit instruction of vocabulary learning and inferencing strategies, encourages vocabulary gains and comprehension of texts. Another important factor to be considered in L2 vocabulary development is the complexity faced in learning low frequency words in technical domains of learning. Coupled with lexically dense texts and lack of associative links while encountering low frequency words, L2 learners may grapple with their skills and proficiency while selecting suitable strategies for text comprehension. It is not clear whether L2 learners focus on word forms, context or referential knowledge to derive meaning from lexically dense texts. Lack of information detailing L2 learner responses to such challenges warrants investigative research.

1.2 Objectives of the Research

The objectives of this study are specifically to investigate patterns of inferencing strategies; to investigate the role of context on inferencing strategies, and to analyse the role of teaching explicit inferencing strategies in the vocabulary development of L2 learners.

This Chapter discusses the background of the study, provides an overview of English language education in Sarawak and the region, discusses briefly the pur-

pose of the study, the research aims and the significance of the study, and concludes by providing an overview of the whole thesis.

1.3 Background to the Study

The motivation to conduct this study is linked to the increasing importance of English language vocabulary proficiency in tertiary settings and its strong connection to meaning construction in reading. Given the significance of vocabulary knowledge for oral and written communication, it is clear that there is a need for explicit instruction of vocabulary strategies and for vocabulary awareness to be embedded in the curriculum for L2 language teaching. In recent years research has established that vocabulary is the most important aspect of the L2 language to be acquired and that without sufficient vocabulary proficiency the L2 learner may find it difficult to write and speak effectively (Nation & Coady, 1988). Vocabulary inadequacies are exacerbated especially when the L2 learner is in a tertiary academic setting and is expected to use specialised vocabulary or technical vocabulary competently in both written and oral communication. Hence the setting for this study.

It is important that second language courses in academic settings recognise that curriculum development must cater to the needs of L2 learners, as without understanding the objectives of the target language needs, the setting in which the L2 is used and the level of proficiency required, it is arduous to develop curriculum that benefits learners. In other words, it is important to identify the vocabulary needs of L2 learners for developing effectual curriculum. Programmes that develop word knowledge by teaching young learners to learn words have influenced comprehension of text and improved general word knowledge (Beck, McCaslin, & McKeown, 1983; Beck & McKeown, 1991). In addition, evidence for the relationship between vocabulary and reading comprehension comes from studies that directly teach word meanings to children in order to develop comprehension of text (Tannenbaum, 2005). Research in vocabulary studies has supported the view that L2 learners require assistance in understanding word definitions (Bramki and Williams, 1984), and recommendations have been made for vocabulary teaching to be logical and organised (Nation, 2001). However, assertions against 'rich instruction' in language teaching by some

researchers based on the complexities of teaching individual words (Nagy 1997), and the longer duration of time required (McKeown et.al, 1985), make it difficult to advocate direct teaching of vocabulary in L2 learners and warrants that teaching of strategies may be more beneficial. There is also paucity of research evidence to indicate which strategies tertiary L2 learners themselves may use in becoming skilled vocabulary scholars and users.

In this study several theoretical standpoints on vocabulary development have been considered, along with factors such as lexical representation and vocabulary processing in tertiary L2 learners. Psycholinguistic studies of L2 acquisition (e.g. Levelt, 1989) refer to three interrelated aspects of vocabulary acquisition: the study of representation, the study of acquisition, and the study of processing. As Levelt (1989) points out, any theory of L2 acquisition is incomplete without a representation component, because representation and acquisition processes cannot be studied independently of each other. Studies of L2 lexical representation in the L2 learners' lexicon have been meagre. Therefore, it is important to examine how L2 learners manage lexical density in reading texts and create representations and lexical entries to arrive at comprehension and meaning construction in their mental lexicons.

Martin (1985, p.3) states that the text "consists of elements of linguistic substance juxtaposed in linear sequence" and that "in the case of written text the skilled reader internalises from the encounter with graphic substances a model of some aspect of reality". This study posits that L2 learners may not find linear lexical sequences in texts in their reading and may opt for numerous measures that do not follow organised steps to generate meaning.

Fraser (1999) proposes a different categorisation of inference and states that inferencing is an overarching concept for syntactic and semantic cues, dictionary use, and skipping of words. There are, however, distinct gaps in the knowledge of how learners negotiate these processes. It is crucial to understand how L2 learners employ lexical strategies to be proficient in vocabulary learning and which strategies

are considered successful by the learners themselves so that this knowledge can be made available to L2 learners. The underlying belief here is that a systematic understanding of the L2 learners' challenges while encountering low frequency vocabulary is urgent, as it is only by understanding the processes involved in moving through pre-receptive to productive processes of vocabulary development that it is possible to introduce a range of lexical strategies and raise awareness in L2 learners of how successful inferencing and lexical strategy learning leads to effectual comprehension and vocabulary knowledge gains.

Coady (1993) emphasises the importance of vocabulary building as an integral part of reading, viewing it as a strategic skill that is necessary to be included in reading instruction. Still other researchers propose that through the teaching of reading, vocabulary knowledge can be acquired gradually and incrementally in a myriad of contexts through repeated exposures (Stoller and Grabe, 1993). However according to August and Shanahan (2006) there is limited evidence that cognate knowledge is associated with the development of reading comprehension in English. This may be especially true when the L1 and L2 cognates have minimal similarities as in the case of Chinese and Malay L1 cognates with English, although in the present study there is some evidence that a small proportion of L2 learners have used interlinks between L1 and L2 cognates to determine meaning during reading texts.

It has been recommended that instruction in L2 learning pay greater attention to word-level skills (Nagy, 1997) early in the process and more direct attention to reading comprehension later on. However, in the present study it is believed that vocabulary strategies, inferencing, and background knowledge should be emphasised intensively throughout the entire period of study. For L2 learners to develop efficient word recognition skills, they must first develop good decoding and orthographic skills, and morphemic skills. Without efficient word recognition strategies, learners would not be able to achieve satisfactory levels of comprehension during reading.

Language teaching is arguably tied to language education policies. Extensive resources, both human and financial, are organised around the world to respond

to the need for language teaching that is appropriate for the communicative needs of learners (Savignon, 2006). Therefore, the selection of methods and materials appropriate to both the goals and context of language teaching should commence with an analysis of learning in a given educational setting. For L2 learners in tertiary academic setting, vocabulary learning should consider learners' ability to create semantic references, discipline references, and collocational references. In this study it is believed that raising awareness of effective inferencing/vocabulary learning strategies is required to empower tertiary L2 learners to take control of their own vocabulary advancement.

1.4 English Language Education in Malaysia and Sarawak

The growth of the use of English language in the 'outer circle' as delineated by Kachru (1985) in countries such as Singapore and Malaysia has been tremendous. In Malaysia, the growth of English has been steady and more efforts have been taken by English language researchers and teachers to encourage English proficiency among school students, particularly secondary school students. Initiatives have also been taken to bridge the gap that exists between urban and rural school students in English language proficiency. In recent years, attempts by researchers to promote the use of English and inculcate the reading habit in rural secondary school students in Malaysia have shown positive effects (Asraf & Ahmed, 2003).

School education in Sarawak falls under the authority of the Ministry of Education which is in line with the Malaysian Government's aim to integrate the education system throughout the country. The medium of instruction in most schools in Malaysia, a former British colony had been English. This was changed to Malay medium from 1970 onwards, less than two decades after the nation gained its independence in 1957 (Ministry of Education Malaysia, 1998).

Although *Bahasa Malaysia* or the Malay language is the national language, English is a compulsory subject in all schools and is taught as a second language in all national or government schools. The curriculum for English language teaching in Malaysian schools uses a communicative model of teaching, and incorporates the four skills of reading, writing, listening and speaking through specific learning tasks (Murugesan, 2003).

In the mid-1990s, the Malaysian Government initiated major educational reforms by formulating new legislation on education in order to affirm the position of English as a second language. These reforms were tabled in the Parliament from 1995 to 1997 and covered all levels of education from pre-school to higher tertiary education (Eighth Malaysia Plan, 2001). In 2002, the then Prime Minister, Mahathir Mohammed announced to the Parliament a RM 5 billion allocation to implement the teaching of Mathematics and Science in English (Kamogawa, 2003). Further, allied to Malaysia's plan to become a fully developed nation by the year 2020, steps were being taken to improve literacy rates from 85% to 100% by developing an "information-rich" society (Zaman, 1998). The government's aspiration for Malaysia to be known as 'the regional centre for educational excellence' aligned to its vision 2020 has witnessed the setting up of several branch campuses in Malaysia by overseas universities with Curtin University of Technology being one among them. The present study is situated at Curtin University of Technology, Malaysia.

Malaysia has seen a remarkable growth in higher education in the last 40 years and the need to produce more graduates from Science and Technology has witnessed the passing of the Private Higher Educational Institutions Act (PHEIA) in 1996 (Yaakub and Mahdzan,1999). The Act authorised private institutions of higher education and foreign universities to establish branch campuses and science and technology courses were offered to increase enrolments at higher educational institutions in order to create larger numbers of skilful graduates (Kamogawa, 1998).

The Ministry of Higher Education (MOHE) was established in 2004 and is mainly responsible for tertiary education in Malaysia. The MOHE's mission is:

> [t]o create a higher education environment that will foster the development of academic and institutional excellence. It is in line with the vision of the government to make Malaysia a centre of educational excellence and to internationalise of Malaysian education (Malaysia Centre of Educational Excellence, 2009).

Efforts to internationalise Malaysian education are not without challenges, especially as the national language policy affords the highest place to Malay language. Subsequently educators in Malaysia are often faced with the challenges of re-defining the status and role of English language in Malaysia (Zakaria, 1997). English language proficiency in some Malaysian public universities was admittedly not up to expected levels as evidenced through studies which stated that there was a noticeable gap between teaching English in Malaysian schools and at universities, to the effect that while receptive skills were focussed on, productive skills which were highly desirable in university students were not emphasised sufficiently in schools (Zakaria, 1997). Reports about unemployment rates of university graduates in a Malaysian local daily also points to poor communication skills in English as one of the causes for the staggering 70% unemployment rate among local graduates, whereas in contrast the employment rate among graduates from private institutions was recorded at 26%, and among graduates who had studied abroad at 34% (Ram, 2006). Malaysia's business community also expressed concerns about the decline in recent years in English standards among Malaysian school students and stated that English proficiency was imperative to Malaysia's international competitiveness ("In Malaysia, English Ban Raises Fears for Future," 2009). In effect, English language proficiency is a much valued attribute among Malaysians.

The role of English language in Malaysia has been described by some academics as 'functional' mainly due to the teaching approaches, the curriculum, learning outcomes and assessment patterns, and in part, due its status as an interna-

tional language of communication. The official role of English language is that of a second language with Malay as first language and Tamil or Chinese as third language (Kamogawa, 2003). Nevertheless, English language is considered a critical language of commerce in order for Malaysia to maintain its competitive edge (Mustapha, 2009). English language teaching approaches correspond to second language teaching approaches where the emphasis is placed on the mechanics of the language, usage in daily life activities, and for understanding global perspectives and issues. Despite a focussed approach, many Malaysian English language researchers agree that there is a decline in Malaysian students' English language proficiency in recent years (Khaw, 2008).

In 2003, the Ministry of Education introduced the teaching of Mathematics and Science in English in both primary and secondary schools in an attempt to improve English language proficiency, which found an overwhelming resonance in its citizens. According to research studies (Ab.Rahman et al.,2005) the initiative to increase English language proficiency among Malaysian school students had received positive responses from teachers as well. Studies on teachers' competency had shown that the implementation of the teaching of Mathematics and Science in English had been satisfactory (53.4%), and that the confidence of teachers to teach Mathematics and Science in English had improved (Ab. Rahman et.al, 2005). Renewed focus on the increasing of English language proficiency through various approaches and strategies in the Malaysian education system continued. In 2009, however, six years after the introduction of teaching Mathematics and Science in English in government schools in Malaysia, the Malaysian government reviewed the implementation of the teaching of Mathematics and Science in English citing reports of poor performance in rural students in these subjects. A decision was made to revert the teaching of Mathematics and Science in schools in the Malay language or *Bahasa Malaysia*. The reversal policy is set to commence in 2012 following the announcement by Education minister, Muhyiddin Yassin, that evidence gathered in a one year assessment had shown that the English medium education policy introduced in the country in 2003, had not been effective and had in fact affected the learning of students' L1 (Lotbiniere, 2009).

Fears of declining English standards expressed by the citizens of the nation were allayed by the government through announcements for strong measures to be implemented to enhance the development of English for building English language capacity in Malaysian school students and to prepare them to compete in an overwhelmingly global environment. To mitigate the perceived decline in English language proficiency, the government stated that it would take measures to increase the English language proficiency of Malaysian students through additional English language classes of up to 30% in a week, and through increased employment of English language teachers for this activity ("Malaysia Drops English Language Teaching," 2009).

The role of the English language in the Malaysian school education system has always been a contentious issue among its citizens, be they academics, educators, or the general populace. The proponents for more English language education to be embedded in the national education system have urged the government not to effect the reversal policy announced for the teaching of Mathematics and Science in English back to the Malay language. Nevertheless, the reversal policy announcement was well received by a pleased faction of the populace who wish to preserve the sanctity of the Malay language and uphold its role as the national language. Among the reasons cited for opposing the teaching of Mathematics and Science in English is that teachers teaching the subjects are themselves not proficient in English and that conceptual knowledge was best delivered in a learner's L1. Arguments not withstanding, the policy reversal to teach Mathematics and Science in Malay was finalised according to the government and further discussions were no longer welcomed on the subject.

Aligned to the Ministry of Higher Education's vision to internationalise Malaysian higher education, Curtin University of Technology, Sarawak Campus was established in 1999 in Miri, Sarawak as an offshore campus of Curtin University of Technology, Perth, Western Australia, in partnership with the Sarawak government. All the courses conducted on the campus are taught in English. The students are also required to show competence in English by meeting the Curtin English language re-

quirements for entry into the courses adhering to the English language entry requirements in all Australian universities or universities in Western countries. The University is expected to contribute significantly to Malaysian tertiary education and to academic research in all the various disciplines. With English being established as a global language (Crystal, 1988), English language has taken on a progressively more important role in a range of characteristics of international education and academic research in many countries. The growing global prominence of English is also acknowledged by Kachru (1998) who believes that English has gained supremacy as the language of currency across the world with its global reach.

> [T]he English language is now the most sought-after medium for initiating and accelerating bilingualism or multilingualism. This crossover across borders has brought various strands of pluralism to the language. The need, then, is for the reconstruction and rethinking of what pluralism implies with reference to creativity in the language and its functions and our conceptualisation of English around the world (Kachru,1998, p.5).

Therefore there is a need to understand how vocabularies are applied and integrated in English in various roles and contexts. In this respect, L2 vocabulary developmental research in English language stands to contribute significantly to educational research conducted in pedagogical contexts in Sarawak.

1.5 Purpose and Context of Study

The main purpose of the thesis is to analyse the vocabulary learning patterns in tertiary L2 learners and to establish a model that introduces the notion of the prior vocabulary knowledge of the L2 learner, and also to ascertain if pre-receptive vocabulary has any influence on how the learner acquires vocabulary. The study has attempted to categorise the patterns of vocabulary inferencing strategies employed by

the L2 learner; understand the role of context on the strategies; and examine the influence of teaching explicit inferencing strategies. According to educational theorists such as Piaget, the learner is in "cognitive conflict" when he or she comes across new knowledge that cannot be related to prior knowledge (Gredler, 2001). The new knowledge, or in this case, the new lexical unit/item that the L2 learner encounters, needs to be adapted, assimilated and then accommodated as mental representation into the lexical knowledge of the learner. The process is then assumed to move along a continuum through the lexical positioning of new vocabulary and by the actual inferencing of the new lexical item, which leads to productive vocabulary. The purpose of the study is to establish an L2 vocabulary model to account for the development of pre-receptive (PR) to productive (PV) processes of vocabulary development.

Meara (1997) postulates that modeling is a useful way to represent the processes involved in acquiring a vocabulary. The development of vocabulary models is necessary because they not only influence researchers and academics but also classroom teachers. It is vital to identify the transfer strategies made by the L2 learner to retain the extended senses of single word forms or to learn the different meanings of lexical items and to understand how the L2 learner makes inferences from the text context into existing schemas so that teaching strategies that match the learner strategies can be developed. The new PR-PV model attempts to chart how L2 learners navigate word meanings of new words encountered in text and progressively move through various stages of word production processes to develop productive vocabulary in mental lexicons.

Vocabulary acquisition is fundamental to language teaching and learning with regard to the formation of syllabuses, assessment of learner performance, organisation and provision of learning resources, and most importantly, the perception by learners of language and its learning difficulties. Studies on vocabulary development in context and social and constructivist environments in second language learning of English are scarce in studies on second language teaching methodology and therefore the findings and results achieved in the present study are potentially significant. In particular, the thesis has focussed on providing details regarding L2 learner lexical

negotiation processes for arriving at comprehension and meaning construction during reading activities. Through an analysis of the verbal protocols gathered in phase one ,(see chapter 5) it was possible to categorise and confirm 16 strategies inclusive of existing lexical strategies identified through previous research studies as well as categorise new variant strategies. These verbal protocols also allow glimpses into how mental representation of words, their meanings and related links to other words are formed by L2 learners.

The findings from the study seem to indicate that innate lexical schemas are created by the L2 learner through social learning networks involving language instructors and peers where cognitive mechanisms are initiated in the learners due to the interactions occurring in their learning environment. The findings also point to preferences by a small group of L2 learners in the study to form interlinks between L1 and L2 cognates and use knowledge transfer to achieve comprehension and vocabulary development. In addition, the lexical inferencing strategies have been grouped under, cognitive, syntactic-memory, semantic-memory, meta-cognitive, and cognitive-social or social-constructive vocabulary learning strategies. The role of the context and the ways in which L2 learner derives meanings from context have been highlighted through the current study.

The inferences drawn from the study advocate explicit vocabulary instructional methods that encourage in L2 learners the usage of new words through vocabulary production activities. It is believed that increased opportunities for understanding new and known words facilitate processing of semantically related words more easily. The results of this thesis tend to confirm that careful consideration of the various elements leading to L2 vocabulary development, such as encouraging selection of efficient inferencing strategies, providing opportunities for strategy use, designing of appropriate tasks to match vocabulary production and explicit instruction of vocabulary inferencing and learning, are necessary.

1.6 Organisation of the Study

This thesis is organised into seven chapters. In Chapter 1, the study is introduced through a brief discussion of L2 vocabulary learning theories and concepts that are integral to the current study. Further, Chapter 1 provides the background of

English language education in Malaysia and Sarawak, where the study is situated. The statement of objectives, and the purpose and context of the study are also outlined in Chapter 1. A summary of the significance of study and the organisation of the thesis is given in Chapter 1. In Chapter 2 a critical review of the relevant literature pertaining to the study and the related linguistic theories that underpin the study and form the theoretical framework for the study is provided. A description of how the theories are linked to the conceptual L2 vocabulary model developed through an analysis of the emergent premises from the study is also provided in Chapter 2.The notion of pre-receptive vocabulary as a fundamental aspect in the understanding of L2 vocabulary development is introduced in this chapter. In Chapter 3, comprehensive descriptions of assessments in L2 vocabulary development are given and detailed explanations for the development of diagnostic and achievement vocabulary measurement tests for measuring L2 vocabulary development in adult tertiary learners are provided. In Chapter 4 the research design, the methodology, and the rationale for research approaches used in the study are described. The data collection methods, the stages through which data was collected and data analysis processes, which includes the development of a theoretically derived model for L2 vocabulary development are further elucidated in Chapter 4. The data selection procedures for measuring vocabulary proficiency and limitations of the study are also explained in Chapter 4. Chapter 4 provides descriptions of the previous educational experiences with which participants entered the study and also details the significance of the findings.

In Chapter 5 the findings of the study in relation to research questions 1 and 2, focussing on the inferring strategies in adult L2 learners of English identified in the study through a detailed and descriptive data analysis are provided. In Chapter 6 discussions related to research questions 3 and 4 that centre on the validation of the theoretically derived conceptual model and instructional mediation in the light of the findings are detailed. Chapter 7 consist of a critical overview of the entire thesis and provides suggestions for further research.

Chapter 2- Literature Review

This chapter firstly establishes a theoretical linguistic framework for vocabulary development in L2 learners through a review of the relevant L2 acquisition theories, linguistic schema theories, connectionist views of the lexicon, learnability theories, cognitive-psychologycal theories and sociolinguistic theories, and identifies their relevance to inferencing strategies in L2 vocabulary development. It then introduces the notion of pre-receptive vocabulary as a significant concept in the context of L2 vocabulary development and positions pre-receptive vocabulary in relation to receptive and productive vocabulary.

Against the above theoretical background, the modelling of L2 vocabulary development, leading to the conceptual design of a model of L2 vocabulary development in context, is discussed.

2.1 Linguistic Theories and Vocabulary Development

The following sections will analyse key linguistic theories and examine their relevance to inferencing and vocabulary development in L2 learners.

2.1.1Chomsky, Universal Grammar, and Principles and Parameters Theory

Chomsky (1957) and his followers have investigated the role of deep structures containing prototypal representations of language structure. His theory of generative grammar has been a guide for many linguists around the world and his foundational work on the internalist view of language has had extensive implications in

linguistics and applied linguistics (Smith, 1999). Further, Chomsky (1957) postulated that the capacity for acquiring deep structures is innately human, although which structures are acquired depend on the language of one's culture. Chomsky (1981) stated that representation of words is abstract and individuals connect sounds to meaning through a computational system which leads to a mental representation of concepts. This principle is significant in L2 vocabulary learning, as selecting lexical or inferencing strategies depends on the semantic, syntactic, morphological and formal clues available to L2 learners in a reading context.

Chomsky's (1968) theory of Universal Grammar encompasses principles that specify a subsystem of rules that provide the framework for any language and a range of both formal and significant conditions that any further elaboration of the grammar must meet. He sums up Universal Grammar theory as a schema relevant to the analysis of any language system. Chomsky (1968) recommends that linguists must first ascertain the innate schema that characterizes the class of potential languages, before proceeding to make detailed studies of the nature of stimulation and environment interaction that initiates cognitive mechanisms in the learner. This theoretical position provides insights into how a target language can be learned and retained and how a L2 learner's prior vocabulary knowledge and established L1 schema may influence the selection of L2 inferencing or lexical strategies.

Chomsky suggested that the answer to study of language lay in the study of human mental processes and that words have internal structure and are analytically related (Chomsky, 1986). Besides referring to analytical relations between words, Chomsky also proposed referential dependence, thematic relations, quantification and scope (Chomsky, 1986).

While Chomsky argued that such relations and dependences are not explicit linguistic knowledge taught to a child by parents or caretakers, he maintained that the

principles and rules related to language learning are innate and universal. All the above concepts proposed by Chomsky regarding analytical relations, referential dependence, thematic relations and quantification and scope have direct linkages to the inferencing strategies utilised by L2 learners to construct meaning from context. The knowledge of how analytical relations, referential dependence, thematic relations and quantification determines selection of inferencing strategies is valuable in L2 vocabulary acquisition as it assists understanding on the notion of interlinks developed between L1 and L2 as well as knowledge transfer for comprehension and vocabulary development in the mental lexicon of L2 learners.

The theory of Principles and Parameters argues that the syntactic knowledge of a person can be modelled with two formal mechanisms: a finite set of fundamental principles common to all languages and a finite set of parameters that determine syntactic variability amongst languages (Chomsky, 1986), whereas Minimalism provides a link between sound and meaning, between representations of the pronunciation and representations of the logical properties of words and sentences (Chomsky, 1995). Representation is a critical aspect of vocabulary acquisition and must be considered in relation with L2 learning processes. Minimalist programme of generative grammar treats lexical components which create meaning and expression as a starting point of derivation which eliminates deep structures and surface structures described in the government and binding theory version of generative grammar (Chomsky, 1981). According to Chomsky (1995) a grammar must define two levels of representation: PF (phonetic form) which refer to phonological rules and LF (logical form) which refer to semantic representation (Chomsky, 1995). This concept has associated links in L2 vocabulary development as the L2 learner depends on phonetic and logical formal cues, implicative and explicative, available in a context for meaning construction, as indicated in the conceptual theoretical model of L2 vocabulary learning developed in the present study.

Principles and Parameters theory and Government Binding theory together makes Universal Grammar which highlights the significance of lexical items in the

mental lexicon through which speakers recognize what the words in their language mean and sound, and also how they are used in sentences. Principles and Parameters theory also incorporates the syntactic description of the sentence with the properties of lexical items via the projection principle, which requires the syntax to accommodate the characteristics of a lexical item (Cook & Newson, 1996). Lexical positioning is considered to be an important aspect of the analytical model of conceptual understanding of word comprehension and acquisition in the mental lexicon of the L2 learner, developed in the present study.

2.1.1.1 Chomsky, Universal Grammar and Principles and Parameters Theory, and their Relevance to Inferencing

Broadly speaking, Chomsky (1981) characterises the initial state of the language faculty as an inherent understanding of Principles and Parameters of language organisation which will be triggered by linguistic data available. Further Chomsky's discussion of the notion of Universal Grammar in its wide-ranging awareness as related to the field of language acquisition, and in its scientific realisation in the field of syntax as a recursive procedure for engendering sentences in a language (Chomsky, 1981; Chomsky 1986) offers insights into how a language is acquired. Studies in vocabulary research have revealed that L2 learners employ a series of processes for text comprehension. Understanding a text involves constructing a rational interpretation of the information presented in a text, or in other words *inferencing*. At a general level, inference is a cognitive process used to construct meaning. "Inference in reading comprehension is a constructive thinking process because the reader expands knowledge by proposing and evaluating competing hypothesis about the meaning of the text in an attempt to progressively refine understanding" (Davoudi,2005p.106-107). Inferencing strategies may equip or assist the reader to effectively use background knowledge for comprehension.

Inferencing can be linked to Chomsky's characterisation of the language faculty as a set of principles and parameters where the L2 acquisition requires resetting parameters based on the background or prior information available to the L2 learner. In inferencing the L2 learners depend on linguistic cues available to them in order to construct meaning. Principles and Parameters theory places emphasis on lexical items through which speakers recognise what the words in their language mean and sound, and this is crucial to the perspective on the L2 inferencing strategies identified in this thesis and the network of lexical entries: semantic, syntactic, morphological and formal, that informs the theoretical L2 vocabulary development model developed in the current study.

2.1.2 Linguistic Schema Theory

The following section provides a critical overview of literature on linguistic schema as they apply to the theories of L2 vocabulary acquisition in which linguistic schema is specifically summed up in the processes of reading. How the present study responds to critical issues identified in the literature is emphasised. The main concerns and dilemmas ascertained in the literature with regard to linguistic schema and reading are discussed in relation to the present study's aim in furthering theoretical constructs and the development of a model for L2 vocabulary acquisition.

The concept of schema goes back to gestalt psychologists and was postulated by Bartlett (1932) and is also a key concept in Piaget's (1970) theory of language acquisition. Piaget stated that people are born with schemes, a tendency to organize their thinking processes, which he called reflexes. These schemes are basic building blocks, organised systems of actions or thoughts that enable us to mentally represent the objects and events of the world in an attempt to adapt to the environment. As schemes become increasingly more complex they are termed structures (Piaget, 1970). In Piaget's view, a schema includes both a category of knowledge and the process of obtaining that knowledge. The schema theory has been further adopted by theorists such as Rummelhart

(1977) and Widdowson (1983) who state that word inference can be seen as a process of search for and use of, relevant schemata to identify unfamiliar verbal stimuli. Schema theory is an important concept in the present study.

Singer's theoretical formulation (1985) of the role of conceptualisation in reading behaviour is integrated with the substrata-factor theory. Singer (1985) proposed that readers develop meaning for words concomitantly so that word-recognition substrata and word-meaning substrata can be integrated. However, no strategies have been proposed as to how students may develop meaning for words concomitantly.

Singer's studies focussed on early age L1 learners' capacity for conceptualising mediation responses to their reading and therefore may not apply to how similar responses could be formed by adult L2 learners. Brown & Yule (1983) define inferencing as the links learners construct when they attempt to interpret texts. Inferencing is seen as one of the essential cognitive processes in reading comprehension (Anderson & Pearson, 1984; Graesser & Bower, 1990, Kintch, 1988, Monzo & Calvo, 2002; Bengeleil & Paribakth, 2006). It occurs at all levels of reading comprehension processes, ranging from integrating the text with background knowledge, to linking the different parts of the text together with unknown aspects in the text to reach a lucid pattern of the information in the text (Kintch, 1988, 1998). The present study is concerned with identifying inferencing strategies in L2 learners with Chinese/Malay L1.

Essentially, schema theory relates to how information is stored in schemata and holds that readers possess different conceptual frameworks, called schemata, which they draw upon in the reading of texts and which they use to discern contextual clues. These schemata are utilized by readers in interactive bottom-up and top-down processing. Schemata provide a framework for readers to validate their knowledge of the text, fill in

information gaps within the text, and clarify ambiguities (Steffenson & Joag-Dev, 1984). Competent readers use prior knowledge of content and textual features stored in schemata to make meaning out of the text (Rumelhart, 1977; Goodman, 1984).

Numerous theories about reading comprehension exist in which different aspects of the reading process are rationalised: recognising letters and words, syntactic parsing of sentences, understanding the meaning of words and sentences, incorporating the meaning of the text into existing current knowledge about the topic and so on. Kintsch and Van Dijk's theory (1978) describes the reading process, from recognising words to constructing a representation of the meaning of the text and accentuate understanding the meaning of a text. In 1988, the theory was extended with the so-called construction-integration model (Kintsch, 1988), followed by an updated theory in 1998 (Kintsch, 1998). This theory has been used by many researchers as a starting point for constructing models and theories.

As a reader reads a text, an understanding of the text is created in the learner's mind. The process of constructing a situation model is called the comprehension process. Van Dijk and Kintsch (1983) assume that readers of a text build three different mental representations of the text: a verbatim representation of the text, a semantic representation that describes the meaning of the text and a situational representation of the situation to which the text refers. The notion of a propositional representation is that it consists primarily of a list of propositions that are drawn from the text. After having read a complete sentence, this list of propositions is transformed into a network of propositions. If the text is coherent, all nodes of the network are connected to each other (Chun & Plass, 1996). The situational representation is comparable to the mental models described by Johnson-Laird (1983) and Johnson- Laird & Byrne (1991). However, it is unclear as to how L2 learners make such connections leading to vocabulary development.

Theoretical accounts given by Wolter (2006), focusses on aspects of how learners might draw upon L1 lexical and conceptual knowledge when making assumptions about connections between words in the L2 lexicon. Wolter (2006) ponders whether or not similarities between L1 and L2 lexical networks provide learners with any advantages in obtaining a well developed L2 lexical network. While, it is of interest that similarities in L1 and L2 lexical networks may allow certain groups of L1 learners to make better assumptions about the target language, it is not demonstrated how it is attained. An interesting detail raised by Wolter (2006) is the difference that exists between paradigmatic and syntagmatic connections between words whereby he states that paradigmatically related words bear a hierarchical connection to each other and can normally fill the same syntactic gap in a sentence, as in (dog → animal). On the other hand, syntagmatic connections exist in collocations and other types of connections which are typically from other word classes and are in accord with a certain word, as in (dog → bite, bark, furry etc.). Wolter (2006) proposes that the process of building syntagmatic connections between words in an L2 seems to be appreciably more difficult than the process of building paradigmatic connections, due to the fact that adding syntactic connections will require restructuring of the existing network, but on the contrary paradigmatic connections will not require the L2 learner to do so. This notion contradicts previous research findings (Piper & Leicester, 1980, Soderman 1993 and Wolter, 2001 as cited in Wolter, 2006) which revealed that paradigmatic responses on a word association test point towards a higher level of development.

Wolter (2006) concludes that it seems conceivable that the process of acquiring syntagmatic connections of words is much more complicated than paradigmatic connections of words and recommends more research be carried out in this area. The present study attempts to categorise strategies employed by adult L2 learners towards vocabulary development and create a model that cogently explains vocabulary development procedures in a specific class of L2 learners with Chinese/Malay L1.

2.1.2.1 Linguistic Schema Theory and its Relevance for Inferencing

In this study the premise of inferencing is believed to be that of a cognitive process in reading through which L2 learners build upon existing knowledge by drawing upon various knowledges such as linguistic knowledge, background knowledge, and prior knowledge of vocabulary in order to construct meaning. In this respect schema theory has a direct relevance to inferencing as it relates to how information is stored in schemata and maintains that readers possess different conceptual frameworks, called schemata, which they use to discern contextual clues. Schema has an immediate link to inferencing in that it searches for and use pertinent schemata to identify verbal stimuli. Singer (1985) declares that forming concepts through different methods allow readers to recognize words through various modes and so when learners come across unfamiliar words, they have to mentally process the content and redirect most of the effort into operation of word-recognition substrata. This has implications in the way inferencing strategies are employed by L2 learners during reading, which is the phenomenon investigated in the present study.

2.1.3 Connectionist Views of the Lexicon

This section discusses the connectionist's view of the lexicon and the existence of codified multi-words and their role believed to contribute to productive vocabulary. Lafford, Collentine & Karp (2000) describe the connectionist view of the lexicon as the modelling of neural organisation and processes of language. They state that connectionists believe that the brain stores information in networks of nodes, or discrete knowledge structures.

"…[T]he process of creating (binding) form-meaning relationships occurs when neural networks are strengthened over time as the learner

frequently encounters the item in the input. The connectionist perspective predicts that, while different levels of representation are localized (neurologically speaking), there is no strict modularization" (Lafford, Collentine & Karp, 2000).

Connectionism views linguistic knowledge to be integrated with academic knowledge. For example, Universal Grammar (UG) predicts that vocabulary errors result from erroneous lexical entries or performance factors (Levelt, 1989). A connectionist's percepective views an error as an insight into the organisation of lexical knowledge and that knowledge's relationship to other knowledge sources. The connectionist perspective recognises that the words that learners use are quite sensitive to so-called priming effects, or the processing of one node simply because a related node (i.e., one that is semantically or structurally related) has been activated (Levelt, 1989). For example, in an activity relating to food, a learner may find it difficult to generate in the target language a term relating to medicine even if the term is fully acquired, since the learner's cognitive activity does not activate medical terms.

The connectionist view not only recognises the existence of codified multiword chunks in the lexicon, but some theorists put forward a central role for them during production of vocabulary. Crick (1979) asserts that the mind has a vast storage capacity but a limited processing capacity. Fluency, he asserts, is the use of prefabricated and memorised lexical phrases rather than the employment of syntactic rules.

In summary, connectionists propose that language production is the "retrieval of larger phrases units from memory" rather than rule governed (Zimmermann 1997:17). This differs from UG lexical perspective as an "accumulation of entities" (Lafford, Collentine & Karp, 2000), which is a more appropriate starting point for the present study as L2 vocabulary learning is a complex cognitive phenomenon that is not dependent on singular factors.

Ellis (1997) gives a description of the connectionist organisation of the L2 lexicon. Ellis (1997) further states that the key organisational principle is the implicit/explicit knowledge continuum. Implicit knowledge is implied and contains knowledge sources that help the learner to encode (i.e., speaking and writing) and decode (i.e., reading and listening) lexical items, termed input/output (I/O) channels (Ellis, 1997). Explicit knowledge is conscious i.e., available for meta-cognition and its use requires many resources. This represents the concrete and abstract experiences that a language encodes. Ellis (1994: 226-7) theorizes that one's L1 and L2 implicit lexical knowledge stores are localised separately, while one's explicit stores are localized jointly. This implies that a learner's semantic and structural knowledge for any given lexical item is then distributed across both explicit and implicit knowledge reserves. This notion informs the conceptual theoretical model of L2 vocabulary developed in the present thesis.

2.1.3.1 Connectionist Views and their Relevance for Inferencing

The study proceeds from the assumption that inferencing is a cognitive process in which interlinks between the existing schema of L2 learners requires links to be made with new lexical knowledge schema encountered. The role of connectionism with regard to inferencing is based on the view of how linguistic knowledge can be integrated with academic knowledge leading to the development of productive vocabulary. This is especially true in the context of L2 learners when new lexical knowledge often interacts with academic knowledge gained through specific discipline areas. The focus of the present study is on the inferencing strategies employed by first year engineering students whose L2 is English, where the L2 learner comes across an extensive array of new lexical knowledge which is discipline based. Connectionism is viewed in the present study as a basis for productive vocabulary which can be achieved through successful L2 inferencing strategies utilised in reading for comprehension, and when the transfer of new lexical knowledge is gained as part of their mental lexicon.

2.1.4 Second Language Acquisition Theories and L2 vocabulary acquisition

A review of second language acquisition theories and their relations to L2 vocabulary learning theories is presented in this section, which attempts to highlight the complexities in the comprehension of word knowledge in L2 learners. Linguists are aware that children acquire lexical items rapidly as they build grammatical structures. For example, Fenson et al. (1994) report that young children have a receptive vocabulary of about 15-80 words and that comprehension and production continues to grow during the next stages of acquisition. Though it is understood that in first language (L1) acquisition comprehension precedes production, and the theory is maintained for L2 vocabulary learning, the processes occurring between comprehension and production are inherently complex in L2 vocabulary development due to a number of factors. These factors include student attitude, motivation and the social construct of the classroom.

The values invoked in relation to the acquisition of word meaning are not always language specific and other factors such as pragmatics, and conceptual and associated knowledge may be relied upon in the comprehension of new vocabulary (Carter, 1998). Carter's (1998) stance is supported by Bloom (2000) who proposes that the most important element in the process of word learning is the understanding of referential intentions of others who interact with the learners, though in his studies he focussed on development of vocabulary in young children. Bloom (2000) considers four cognitive capacities as necessary to word learning: the ability to acquire concepts, the ability to infer the intention of others, the appreciation of syntactic structure, and certain general learning and memory abilities (p.10).

Other researchers such as Marchetti (2003) argue that meanings are the result of meta-attentional operation and one has to isolate, select and retain them in memory attentional operations. Studies conducted on L2 lexical acquisition in formal instructional

settings indicate that the learner benefits from input tuning from the teacher (Krashen, 1981; Ellis, 1985). *Interaction* refers to communication between individuals, particularly when they are negotiating meaning in order to prevent a breakdown in communication (Ellis, 1999). According to Singleton (1999) formal L2 instruction is likely to give the learner more insights into individual lexical items than a naturalistic acquisition environment. Nevertheless, what strategies and methods benefit the L2 learner most in lexical comprehension remains unclear.

Spolsky's (1989: 28) general model of L2 learning gives an overview of the relationship between contextual factors, individual learner differences, learning opportunities, and learning outcomes, and highlights the various inter-relating factors that come into play in L2 learning. Figure 2.1 shows Spolsky's general model of L2 learning and outlines key aspects that play significant roles in the learning of a second language. The model highlights the multiple factors that interact and influence the linguistic and non- linguistic outcomes for L2 learners. Spolsky's L2 learning model places emphasises the social context of learning, a factor that is valued in the current study. The model serves as a guide for second language acquisition researchers and offers explanations on how a L2 is developed.

Fig. 2.1 Spolsky's general model of second language learning (Spolsky, 1989:28)

Social context

provides

leads to

Attitudes
(of various kinds)

which appear in the learner as

Motivation

which joins with other personal
characteristics such as

Age	Personality	Capabilities	Previous knowledge

All of which explain the use
learner makes of the available

Learning opportunities (formal or informal)

the interplay between learner
and situation determining

Linguistic and non-linguistic outcomes
for the learner

2.1.4.1 Theories of L2 Acquisition and their Relevance to Inferencing

Interaction, which is an essential element of L2 acquisition, is an important concept with respect to inferencing. The study focuses on investigating the patterns of inferencing strategies utilised by L2 learners in order for successful comprehension in reading through which L2 learners may develop inferential word learning and integrate new linguistic information into developing systems. These processes involve the interaction of peers with peers, instructors with peers and, interaction of existing lexical knowledge with new lexical knowledge. A variety of inferencing strategies are developed by the L2 learner with respect to the quality of interactions and attitudes towards L2 vocabulary development.

2.1.5 Learnability Theory

This section on linguistic theory maps current understanding of the complex mental representations of language, which are stored in the human mind as well as the unique characteristics which makes human language different from other forms of communication (Mitchell and Myles, 1998).

Research studies conducted by cognitive scientist, Pinker (2000) indicate that principles of language acquisition can be compared to a branch of theoretical computer science called Learnability Theory, which acknowledges the role of environment in language learning. This premise posits that the instructional/interactive environment plays an important role in all aspects of language learning including vocabulary development. Learnability theory describes learning as a setting involving four parts: a class of languages, one of them being the target language that the learner needs to acquire, an environment in which the learner has to acquire information in the world, a learning strategy in which the learner tries out hypotheses about the target language and a success criterion by which learners may arrive at a hypothesis - identical to the target language after some fixed period of time (Pinker, 2000). This theory is applied in the

present study to establish whether L2 learners benefit from a social constructivist classroom environment in which there is interaction between peers and between peers and facilitators.

2.1.5.1 Learnability Theory and Inferencing Strategies

Learnability theory is significant in the context of inferencing as the L2 learner is positioned in a social learning context where the input of peers and instructors is essential for development of vocabulary. Instructors often adapt their teaching strategies based on student responses and encourage students to analyse, interpret, and predict information. In the study vocabulary learning is based on constructing meaningful representations from context and through making sense of one's experiential world in a constructivist manner. The present study presumes that the success of the inferencing strategies employed by the L2 learners in order to develop vocabulary is determined in the way in which they interact with their learning environment, their peers and instructors in a social constructivist setting.

2.1.6 Cognitive Psychological Theories

Language models such as Anderson's Adaptive Control of Thought, (1990) which have emerged from Cognitive Psychology state that knowledge has to move from declarative to procedural forms through three stages: the cognitive stage, the associative stage and autonomous stage, and focuses on the impact of the stages on language learning. Wenden (1987) states that the theories and research on the nature of the mind in the field of cognitive science have provided the impetus for examining how learners undertake learning target languages. The pedagogical implications of such theories are that L2 learners benefit significantly from awareness of learning strategies. At the early stages of language learning strategy research there was lack of theoretical guidance for empirical investigations and studies into the nature of learning strategies and their influence on L2 acquisition (O'Malley & Chamot,1990). The interest in learner processes

in L2 learning came as a result of a shift in focus in the educational methods, a shift of emphasis from methods of teaching to learner characteristics and their effects on learning (Lessard-Clouston, 1997).

Research in applied linguistics has focussed on what good language learners do in the process of learning a target language (O'Malley & Chamot, 1990; Rubin, 1987). In cognitive theory, learning is an active constructive process where the learners select and organise input, relate the input to their prior knowledge, retain what is important and reflect on the outcomes of their learning efforts (Chamot & O'Malley,1993). This theory is similar to constructive theories of learning, the principles of which can be attributed to Jean Piaget, who stated that knowledge is constructed actively by the learner and is not passively received from the environment (von Glaserfeld, 1987). The belief that the learner constructs knowledge actively emphasises that prior knowledge of the learner is essential in order to actively construct new knowledge.

The above discussion establishes the foundation for the present study. The study places importance on the prior knowledge of vocabulary of L2 learners and its influence on acquiring vocabulary proficiency. O'Malley and Chamot (1990), state that considerable time and effort is required by linguists and language teachers to develop efficient teaching strategies. Their studies report positive effects of teaching strategies in vocabulary development. The strategies employed in acquiring vocabulary in L2 such as English are thoroughly examined in the present study to develop a better understanding of these procedures.

2.1.6.1 Cognitive Psychological Theories and Inferencing Strategies

Cognitive psychological theories suggest that L2 learners benefit significantly from the awareness of their own learning strategies. This belief is directly linked to the development of inferencing strategies in L2 learners leading to vocabulary development, where learning is seen as an active constructive process through which the learners

employ a series of processes in which they choose and classify input, connect that input to their prior knowledge and convert that knowledge into productive vocabulary. The knowledge of inferencing strategies that L2 learners develop through their learning environment and from context is of notable importance in understanding the cognitive processes in L2 vocabulary development.

2.1.7 Social and Linguistic Influences

The similarities and differences in the numerous social and linguistic theories in language learning, the social and linguistic aspects in L2 acquisition, and the ways in which they apply to vocabulary acquisition and to inferencing strategies are examined in this section. A number of researchers see comprehensible input as a major contributory factor in L2 acquisition (Ellis, 1994). The most influential theoretical positions are those advanced by Krashen's Input Hypothesis (Krashen 1981, 1985; 1989) which makes the following claims.

1. Learners progress along the natural order by understanding input that contains structures a little bit beyond their current level of competence.
2. Although comprehensible input is necessary for acquisition to take place, it is not sufficient, as learners also need to be affectively disposed to 'let in' the input they comprehend.
3. Input becomes comprehensible as a result of simplification and with the help of contextual and extra-linguistic clues.
4. Speaking is the result of acquisition, not its cause; learner production does not contribute directly to acquisition.

Krashen's (1981) input theory states that language input is needed for language learning. In a social instructional environment one can infer input as what the L2 learner hears and absorbs from a written text, in addition to mediation and facilitation.

Krashen's input hypothesis was further developed in Long's (1985) Interaction Hypothesis, which states that collaborative effort between more and less fluent speakers is useful for language learning. Krashen's hypothesis came under criticisms for its generality and failure for not specifying methods by which comprehensible input could be analysed and integrated into the learner's L2 (Chaudron, 1985). Similar criticisms have also been expressed from a linguistic point of view by Braidi (1995).

Interaction among language users takes place in informal settings or in formal settings but it can essentially be considered to be social in nature. According to Vygotsky, all key cognitive activities develop in a matrix of social history and form the products of socio-historical development (Luria, 1976). This implies that cognitive skills and patterns of thinking are not largely determined by innate factors, but are the products of the activities practiced in the social institutions of the culture in which the individual grows up. One essential principle in Vygotsky's theory is the notion of the existence of what he called the "zone of proximal development" (Vygotsky, 1985). The zone of proximal development (ZPD) is the difference between the child's capacity to solve problems on his own, and his capacity to solve them with assistance (Schutz, 2004). Krashen's *acquisition-learning hypothesis* seems to have been influenced by Vygotsky.

Vygotsky uses *internalization of language*, while Krashen uses the term *language acquisition,* however, both are based on a common assumption: interaction with other people, pointing to the social facet of learning. By explaining human language development and cognitive development, Vygotsky's social-interactionist theory serves as a strong foundation for the modern trends in applied linguistics (Schutz, 2004). Vygotsky affirmed that words play a central role not only in the development of thought but also in the historical growth of consciousness as a whole and defined the word as a microcosm of human consciousness (Schutz, 2004). The metaphor of *scaffolding* has been developed in neo-Vygotskian discussions to capture the qualities of the type of other-regulation within the ZPD, which is evidently most facilitative of learning of new concepts (Mitchell & Myles, 1998).

According to Wood, Bruner, & Ross (1976) scaffolding helps learners in a variety of ways: to promote interest in task, to analyse critical features and help in problem solving. The above theories have pedagogical implications in the classroom for vocabulary learning. The classroom environment and the procedures by which the L2 learner engages in his/her own learning have a great impact on the vocabulary acquisition processes.

2.1.7.1 Social and Linguistic Influences and Inferencing Strategies

In the context of sociolinguistic and social instructional environments, input is believed to represent what the L2 learner gathers and understands from a text, in addition to mediation from peers and facilitation by peers and instructors. Interaction hypothesis which is an aspect of sociolinguistics states that the collaborative endeavors between more and less fluent speakers is useful for language learning. This has a direct relevance to inferencing strategies used by L2 learners where peer facilitation plays a decisive role in the comprehension and development of vocabulary. The present study is positioned in a background where peer and instructor interaction is seen as an essential component of L2 vocabulary learning.

2.2. Concepts of learning: Lexical Inferencing and Contextual References in Vocabulary Learning

The relationship between lexical knowledge and reading is the focus of this section. Brown and Yule (1983) defines inferencing as the links learners construct when they attempt to interpret texts. Inferencing is seen as one of the essential cognitive processes in reading comprehension (Anderson & Pearson, 1984; Graesser & Bower, 1990; Kintch, 1988, Monzo & Calvo, 2002). It occurs at all levels of reading comprehension processes, ranging from integrating the text with background knowledge,

to linking the different parts of the text together with unknown aspects in the text to reach a lucid pattern of the information in the text (Kintch, 1988, 1998).

Paribakth and Wesche, (1999) states that the comprehension and successful intake of new lexical knowledge while reading for comprehension involves a cognitive process known as *inferencing*. Lexical inferencing involves making informed guesses of the meaning of word with the availability of all linguistic cues available to the L2 learner, in combinations with the learners' general knowledge of the world and their awareness of context (Haastrup, 1991). However relatively little is known about the underlying cognitive processes as reported by researchers, (Paribakth and Wesche, 1999; Huckin and Coady, 1999; Henriksen, 1999).   Text comprehension is said to occur in two complementary processes: bottom-up process based on the learner's language knowledge and top-down process based on associations and predictions (Brown & Yule, 1983). Carter and McCarthy (1999) state that structural approaches to decoding word meanings suggest that the understanding of words does not exist in isolation but through meaningful sense relations made with other words in the mental lexicon by the learner. While it is noted that attention to unknown words is integral, contextual learning of vocabulary should not be ruled out.

Gu (2003) suggests that learning new words from context may be the only first step learners use, and that they should continue, with metacognitive choice of words and treatment, to encode the new word together with the context where it appears (e.g., remembering the word together with the adjoining sentence). The principle of vocabulary development in context is the central theme in the present study. Sanaoui (1995) proposes that learners try creating sentences using the new words learned and thus putting it back into context. Many empirical studies on contextual learning have compared incidental vocabulary learning from context with other forms of vocabulary presentation. Haastrup's (1991) studies focussed on making guesses about the meaning of unknown words based on available linguistic and non- linguistic cues in the text.

Lexical inferencing in L2 learners during reading is widely studied by researchers (Paribakth & Wesche, 1997, Paribakth & Weshe, 1999 ; Frantzen, 2003). Incidental vocabulary learning (Huckin & Coady, 1999; Nagy, 1997) is also linked to lexical inferencing through reading texts and also to natural order hypotheses. Paribakth & Bengeleil (2004) investigated L2 reading proficiency and lexical inferencing in their study on EFL learners with respect to knowledge sources and contextual clues, the rate of success in inferring meanings of unfamiliar words, and the rate at which they learn and retain previously unknown words. The data was gathered through think aloud procedures and interviews, and showed that the respondents used knowledge sources and contextual clues to infer meanings of unfamiliar target words. They also found that participants used formal schemata- such as text structure and text types as well to infer meanings of unknown words. Paribakth and Bengeleil (2004) deduced that in the process of lexical inferencing, L2 readers' linguistic and non-linguistic knowledge sources interact with contextual clues to understand meanings of unknown lexical items. The authors (Paribakth & Bengeleil, 2004) proposed making L2 learners aware of the possible knowledge sources and contextual cues, within and outside the text for making inferences and training them to identify such sources for enhancing efficiency and effectiveness in lexical inferencing skills. The present study attempts to raise awareness in L2 learners through identification of the inferencing strategies employed in reading and through explicit teaching of these strategies.

2.2.1 Lexical Inferencing, Contextual References, and Inferencing Strategies

In reading, the learner forms associations with words encountered for lexical references in order to construct meaning. The associations are formed with prior lexical knowledge and context in order to establish meaning. The learner draws on known linguistic signals from context to form schemas or patterns for successful comprehension. Lexical inferencing is an established facet of reading where contextual references are utilised for better understanding. The inferencing strategies employed by L2 learners in context form a critical aspect of the present study and contribute to how L2 learners

negotiate meaning through interplay of lexical inferencing and contextual references available to them.

2.3. Theoretical Constructs in Reading Comprehension in Tertiary L2 learners

In general, it is accepted that a significant percentage of L2 vocabulary is acquired incidentally through reading (Nagy, Anderson & Hermann, 1985; Nation & Coady, 1988; Nation, 2001). However, L2 vocabulary researchers such as Reider (2002) debate that this theory is not fully cognisant of the processes of vocabulary acquisition. Reading and its inter-relations to approaches to comprehension of meaning, require considerable analysis. Reider (2002) highlights many questions that remain unanswered in the context of L2 vocabulary acquisition. The lexical approach towards language learning concentrates on developing learners' proficiency with lexis, or words and word combinations. It is based on the idea that an important part of language acquisition is the ability to comprehend and produce lexical phrases as unanalyzed wholes, or "chunks," and that these chunks become the raw data by which learners perceive patterns of language traditionally thought of as grammar (Lewis, 1993, p. 95).

Lewis (1993), who coined the term Lexical Approach, suggests a few concepts on the notion of lexis: lexis is the basis of language and language consists of grammaticalised lexis; lexis is often misunderstood in language teaching because it is generally assumed that grammar forms the basis of language and without mastery of it, there will be breakdown in communication. Lexical approach advocates argue that language consists of meaningful chunks that, when combined, produce continuous coherent text (Moudraia, 2001). This implies that prior knowledge of the L2 learner is fundamental to his/her ability to form perceptions in relation to new knowledge and that learning is a process of constructing meaningful representations and of making sense of one's experiential world.

The significance of understanding learning strategies employed by L2 learners in vocabulary acquisition is discussed in this section. Oxford and Scarcella (1994) argue that it is vital to teach students explicit strategies for learning vocabulary and that for adult learners, direct vocabulary instruction is both beneficial and essential. Their research (Oxford & Scarcella, 1994) recommends that vocabulary instruction should take place through contextualised and partially decontextualized activities. Other researchers also (Carrell, Devine, & Eskey, 1988; Dubin, Eskey, & Grabe, 1986 as cited in Coady, 1997) claim that academic literacy skills cannot be acquired naturally and require instruction and training to attain text summarising skills, finding main ideas and identifying rhetorical structures in a text.

Nation (1993) proposes that students using language for academic purposes focus on academic or sub technical vocabulary and engage in extensive reading to build general word knowledge together with materials in the field of specialisation to improve top-down skills in inferring words from context. From an analysis of the various proposals and recommendations put forward by L2 vocabulary researchers, it is evident that explicit teaching strategies that match learner background need to be developed and implemented in the language classroom for successful vocabulary development in learners. The present study describes and analyses the role of explicit teaching of inferencing strategies for vocabulary development in L2 learners.

All appropriate learning strategies are oriented toward the broad goal of communicative competence and therefore developing this competence requires realistic interaction among learners using meaningful, contextualised knowledge (Oxford, 1990). Strategies act in various ways to foster certain aspects of competence such as grammatical, socio-linguistic, discourse and strategic elements. Oxford (1990) stated that memory strategies such as using imagery and structured review, and cognitive strategies such as reasoning deductively and using contrastive analysis, strengthen grammatical accuracy. This view is valuable in understanding strategies employed by L2 learners in acquiring productive vocabulary and how one can assist L2 learners in making connections between image and meaning, for instance. Social strategies such as asking

questions, cooperating with native speakers and peers and developing cultural awareness aid socio-linguistic competence and strategies such as using contextual clues for guessing, social strategies such as cooperating and asking questions encourage discourse competence and compensation strategies like guessing or using synonyms permit learners to use the language despite gaps in knowledge (Oxford, 1990). The study investigates the types of strategies used in relation to vocabulary learning and its influences on L2 proficiency.

The L2 learning process has been identified as a mediated process and it is assumed that students generally benefit from explicit vocabulary instruction in conjunction with reading (Hulstijin, 1992). Constructivist approaches espouse creating meaning from experience (Jonassen, 1991). Constructivist theories of learning advocate that learners create their own knowledge by analysing concepts based on experiential knowledge and applying these to new situations integrating the new knowledge gained with pre-existing intellectual constructs or schemas. In the process of (mediated) learning the learner is the active agent (Webb, 2002). Constructivist proponents believe that instruction depends on learners and environments and emphasize the interaction between these influences more than any other learning theories (Schunk, 2000).

Constructivist methods emphasize the social context of learning through peer collaborative groups and social models (Derry & Lesgold, 1996; Webb & Palincsar, 1996). Cognition is positioned in contexts and instruction must be presented in those contexts (Derry & Lesgold, 1996). Cognitive theories propose that transfer of knowledge occurs when learners understand how to apply knowledge in different settings and that teachers can direct the perception of learners by disseminating information on how knowledge can be used and applied in different situations (Schunk, 2000). The discussion positions the current study in the context of a constructive learning environment.

2.4 Word meanings and lexical knowledge

The following section provide a working definition of what constitutes a word and examine lexical knowledge in comparison to L1 and L2 contexts. Singleton (1999) claims that previous experience of dealing with meaning in L1 can facilitate lexical development in the L2. He goes on to say that in case of similarities in L1 and the target language, the effects of cross-linguistic influence on L2 lexical development may be quite dramatic. Singleton (1999) provides the example of English speakers learning French words ending in –*ation* as in English but with different phonological sounds. According to Singleton (1999) such similarities could lead to a leap in vocabulary development, but on the contrary, it could also lead to a 'faulty internalization' of those words, which constitute exceptions to the general trend. It is possible that faulty internalisation in terms of orthography could occur in Malay L1 learners of English not because Malay is orthographically similar to English, but because Malay has adopted English sounding words into the lexicon. For instance, bus (*bas- Malay*), bag (*beg-Malay*), book (*buku- Malay*) and so on.

Nation & Coady (1988: 98) state that "vocabulary knowledge would seem to be the most clearly identifiable subcomponent of the ability to read", in the light of current experimental and statistical methodology as the tool of investigation. Since the early 1980s there has been a proliferation of publications on vocabulary for L2 trainers, teachers and curriculum designers (Carter, 1988; Carter & McCarthy, 1999; Hatch & Brown, 1995; Nation, 1990; Schmitt & McCarthy, 1997; Willis, 1990). L1 research has generated many publications in relation to the lexicon because lexis has always been the major focus of such research (Singleton, 1999). Recent developments in psycholinguistics such as experimental, observational, theoretical and clinical developments have also focused on L1 lexis, and have continued to build on acquisition, memory studies and organization of lexical knowledge. In particular, the interconnections between elements involved in the construction and functioning of the lexicon such as input and output, form and meaning, spoken and written representations, etc. (Singleton, 1999).

With regard to the investigation of L2 mental lexicon, despite the efforts of pioneer researchers such as Paul Meara (Meara, 1983, 1987, 1992,) good research is scarce. Many questions have emerged from both L1 and L2 lexicon studies which are largely similar, such as the extent to which L2 lexicon resembles the L1 lexicon in terms of the roles of meaning and form and also how lexical knowledge is internalised and organised. The word is central to the understanding of language depending on the level of abstraction at which the language user is operating (Cruse, 1986; Carter, 1998).

> "… [w]ords are described as content words otherwise known as (full words or lexical words) and grammatical words (otherwise known as empty words, form words or function words). Words described as content words are those considered to have little or no independent meaning and to have a largely grammatical role." (Singleton, 1999: 11).

What linguists understand as a lexicon is that which constitutes the component of the language dealing with the meanings of elements of a given language, the phonological and orthographic form of the elements and the ways in which they collocate and colligate. (Singleton, 1999: 29).Traditionally, language was seen as communicating meanings through the medium of concepts. Singleton provides a simplified version of Ogden & Richards (1936) 'basic triangle' is shown in figure 2.2.

Fig. 2.2 Simplified version of Ogden & Richards (1936) 'basic triangle' as shown in (Singleton, 1999: 30)

- 42 -
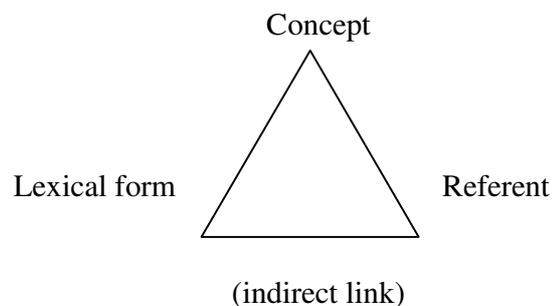
Singleton (1999) argues that the notion that a unique lexical form is associated with a corresponding unique concept fails to account for synonymy where more than one form is associated with a single meaning, and polysemy where a single form is connected with multiple meanings. Ullman (as cited in Singleton, 1999) suggests that this approach would lead to an atomistic view of language where each word would be regarded as a self-contained unit or in other words give rise to an atomistic view .

Structuralism on the other hand does not deny the relationship between words and their referents. Although structuralism had its beginnings in Saussure's *Cours de linguistique générale* (1973), in later years, Bloomfield's (1933) scientific explanation of linguistics was more acceptable among American structuralists. However, Bloomsfield's definitions of words were mostly restricted to the field of chemistry and mineralogy as shown in the following excerpt.

" [w]e can define the names of minerals…in terms of chemistry and mineralogy…but we have no precise way of defining words such as love or hate…" (Bloomsfield, 1933,p. 139).

What lexical competence signifies is often difficult to ascertain or pinpoint due to the different accounts given in the field of lexical research. Richards (1976, p.83) has summarised a series of assumptions about what lexical competence stands for.

1. Native speakers continue to expand their vocabulary in adulthood. Little is known about the average language user's vocabulary but anything from 20,000-100,000 words could be within a person's receptive vocabulary.
2. Knowing a word means knowing the degree of probability of encountering that word in speech or print. For many words we also know the sort of words most likely to be found associated with the word.

3. Knowing a word implies knowing the limitations on the use of the word according to variations of functions and situation.

4. Knowing a word means knowing the syntactic behaviour associated with the word.

5. Knowing a word entails knowledge of the underlying form of a word and the derivations that can be made from it.

6. Knowing a word entails knowledge of the network of associations between that word and other words in the language.

7. Knowing a word means knowing the semantic value of a word.

8. Knowing a word means knowing many of the different meanings associated with a word.

(Richards, 1976,p.83)

However, what clearly constitutes vocabulary knowledge or how many words a L2 speaker needs to learn to attain proficiency are largely unknown. According to some recent estimates, the vocabulary of the average native speaker is about 20,000 words, and children acquire words at an estimate of 1000 words per year (Goulden et al. as cited in Nation & Waring, 2000). Nevertheless, there is no provision made for multiple meanings in these estimates among basic words. Distinctions of meaning- whether homographs, homophones, or polysemy are not taken into account (Nagy, 2000).

The most important concepts in relational semantics are semantic field theory and componential or feature analysis (Singleton, 1999). In semantic field theory, particular lexical areas can be identified and vocabulary is seen as consisting of interrelated networks of relations between words. Componential or feature analysis suggests that the meanings of all lexemes can be described in terms of combinations of universal sense components (Evens, 1988). Lexical knowledge can be examined from various levels, particularly from a qualitative and quantitative angle. Jeffries (1998) states that very little research has been conducted on the correspondences or overlaps between phonology, morphology, lexis, syntax (phrases, clauses and sentences) and discourse. Learning a word requires learning the diverse characteristics of its meaning, and inferring

word meaning from context requires the learner to be aware of the diverse characteristics of the context. Complexities arise, however, when L2 learners' native language interferes in their comprehension. For example, in L1 such as Malay a single lexeme *'kaki'* represent both 'foot' and 'leg'.

Brown & Miller (1994) stated that words can be identified by three criteria: semantic, phonological and grammatical. Semantic criteria would be that a word is 'a unit of meaning', phonological criteria explains the link between the sound of a word and its meaning and grammatical criteria refers to the role/ function of a word in the sentence structure; this belief though widely held and represents a common intuition, cannot be made to apply in any straightforward way (Brown & Miller, 1994). Crain & Lillo-Martin (1999) put forward the referential theory of meaning to explain the networks within semantics. One of the goals of semantics is to explain the 'aboutness' relation that holds between linguistic expressions and the objects that they refer to in the world. This is called the referential theory of meaning. This theory proposes that the "meaning" of a linguistic expression is its reference. According to the Referential Theory of Meaning, then, the semantic value of a linguistic expression is its reference.

Rohde (2002) states that the sound and spelling patterns of words do correlate with semantic and syntactic information. Morphological variants of a noun or verb root generally have very similar sound patterns, and are usually identical up to the ending and the inflectional morphemes at the ends of words are strong indicators of their syntactic and semantic roles(Rohde, 2002). The lexical entry for a noun is simpler than that for a verb. It begins with the singular and plural forms of the noun in the nominative and accusative, although only the pronoun *I* has different accusative forms (Rohde, 2002).

Jeffries (1998) claims that the grammatical aspect of language learning requires knowledge of various combinations and structures; some of the possibilities and restrictions on combinations are grammatical in nature while others are clearly semantic. The above discussion establishes that semantic, phonological and structural knowledge is essential for the L2 learner to develop vocabulary. How such knowledge can be

entrenched in the L2 learner in a formal instructional setting require a pivotal understanding of the strategies that the L2 learners employ to gain comprehension and competence in vocabulary development.

2.4.1. Lexical Knowledge and its Relationship to Inferencing Strategies

The present study is concerned with the inferencing strategies of L2 learners with a focus to the encounter of new words and the internalising and organising of the new lexical knowledge in their mental lexicon. The referents, lexical forms and recognition of concepts formed through the use of various inferencing strategies will inform the model of L2 vocabulary acquisition developed in the study. The study investigates what inferencing processes are used for understanding the characteristics of meaning and how meaning is inferred from context through a tabling of theoretical units of analysis, categorised as known theoretical units of analysis and newly identified strategies.

2.5 Review of vocabulary development theories

Linguists, psychologists and language teachers have been concerned with vocabulary learning strategies and theories for a long time (Levenston, 1979). Vocabulary development has been linked to the nature and quantity of the linguistic input, cognitive abilities, phonological, morphological, and syntactic knowledge (Carter, 1998; Halliday & Hasan, 1976; Richards, 1976). Other researchers such as Bachman (1990) refers to terms such as 'strategic competence' to relate to the abilities of the learners to use vocabulary knowledge.

Read (2000) argues that learners require meta-cognitive strategies not only in communication situations to compensate for a lack of vocabulary knowledge, but also at

the receptive stage of encountering new words in their reading. Meara (1995) cites psychological reasons why it is sensible to teach L2 learners large vocabularies very early on in their learning career. He states that most learners have inadequate understanding of what learning a language involves, but nevertheless are aware that learning a language means learning large number of new words. So, since the learners expect to learn vocabulary it is prudent to make the most of these expectations.

Previous research has focused on how interaction contributes to vocabulary development in second language acquisition. Research on interaction is conducted within the framework of the Interactive Hypothesis, which states that conversational interaction "facilitates [language] acquisition because it connects input [what learners hear and read]; internal learner capacities, particularly selective attention; and output [what learners produce] in productive ways" (Long, 1996: 451-452). Interaction provides learners with opportunities to receive comprehensible input and feedback (Gass, 1997; Long, 1996; Pica, 1994) as well as to make changes in their own linguistic output (Swain, 1995). This allows learners to "notice the gap" (Schmidt & Frota, 1986: 311) between their command of the language and correct, or target-like, use of the language. The interaction hypothesis can be applied to the context of vocabulary learning. However, L2 vocabulary research is yet to explain the patterns and strategies through which L2 learners convert comprehension into word production. Horst, Cobb and Meara (1998) highlighted that studies to show evidence of incidental learning of vocabulary in L2 learners are limited. L2 vocabulary research is also almost silent on how learners process the words in the text psycho-linguistically as they read or whether any of the words they have read have been retained by the learners in their mental lexicon and will be remembered when they are encountered again. The current study focusses among other factors on what variables stimulate the probability that particular words will be acquired and how instructors can enhance vocabulary acquisition through explicit reading and writing activities.

Researchers such as Nagy (2000) have emphasised the lack of knowledge that has weighed down L2 vocabulary studies and the unawareness of the percentage of text that must be known to enable reasonable inferencing. This stresses the need for L2 vocabulary researchers to identify the gaps in knowledge of how the lexicon is organized or how to detail the movement between initial introduction of a word and its receptive and productive phases. Melka (2000) argued that no researcher has attempted to track a word's progress through the acquisition process. This study investigates the strategies employed by L2 learners in the development of vocabulary through pre-receptive and productive phases in order to develop a conceptual model for vocabulary development.

2.6 Context in vocabulary

What a word "means" is mediated by the many contexts in which it is used and such contexts provide considerable input from which language users clearly pick up huge amounts of vocabulary knowledge apart from any explicit vocabulary instruction they may receive. (Nagy, 2000, p.64). Quine (1960) had attempted to explain the problem of how a child forms the notion of context, his description explains to us that a child has to learn a L1 and identify each relevant context within which an utterance can be used. It is prudent to identify whether the mental lexicon of the L2 learners process information in similar ways. Blakemore refers to the Relevance Theory (Sperber and Wilson, 1986 as cited in Blakemore, 1998) to explain how a listener interprets a speaker's coherent utterances. Brown (1998) maintained that though the assumption that language is interpreted within a context of use is well recognized, other aspects such as how participants in interactions set about constructing the context necessary for interpretation, is still unclear.

The concept of communicative competence as a pedagogic objective has been well established by researchers such as Hymes (1973) and has generally been deemed by language researchers as the ability to use language that is contextually appropriate

(Widdowson, 1998). Hymes (1973) states that the transformational grammar theory epitomises the desire to deal with practices, yet in that internality allows for the broadest and deepest of human significance.

Nation & Coady (as cited in Carter, 1998: 101) refers to context as "...morphological, syntactic, and discourse information in a given text which can be classified and described in terms of general factors". There is a wide body of definitions of context in relation to inferring word meanings and to distinguish between concrete context and those related to other factors, such as understanding of world knowledge. Widdowson (1998) posits that context be perceived as assumptions which are culturally shared as schematic knowledge and believes that only through an understanding of the learner as a community member can teachers successfully teach usage of contextual meaning. The author (Widdowson, 1998) refers to earlier definitions of context as being "abstract" (p.10) and states that to understand context one must relate it to a wide range of assumptions that are culturally shared as schematic knowledge. The emergence of the relevance theory explains partly how referential knowledge contributes to inference.

Widdowson (1998) proposes that to understand context in a wider perspective, one needs to look at "grammatical vs. user-oriented points of view, decoding vs. inferential processes, co-textual vs. contextual relations (p.23). There is a need to examine what this means for the learner. The concept of context needs to be deconstructed for understanding how the various facets impact L2 learner processes. The learner needs to draw on various types of vocabulary knowledge of the kind specified by (Bachman & Palmer 1996: 68) such as organizational knowledge, grammatical knowledge, textual knowledge, pragmatic knowledge, functional knowledge and socio-linguistic knowledge, to understand context. Read (2000) states that context refers to more than linguistic phenomenon from a communicative point of view and that socio-linguistic knowledge necessitates knowledge of "cultural references" and "figures of speech"(p 5).

Over the past five decades, psycholinguists have revealed that there are strong differences in the processing of concrete and abstract words. One of these findings is that it is easier for people to generate possible contexts for concrete words than for abstract words; that is, concrete words seem to have higher "context availability" (CA). It is unclear why this difference exists, but some researchers have suggested that concrete words may be used in a smaller variety of semantic contexts (Liebscher & Groppe, 2003)**.** One of the most influential theories is the *Context Availability Model* (CAM) of comprehension (Bransford and McCarrell 1974; Kieras 1978; Schwanenflugel and Shoben 1983 as cited in Liebscher & Groppe, 2003).

According to CAM, linguistic comprehension depends critically on supportive contextual information either from the comprehender's knowledge base or from the external linguistic context. Context density is defined as the proportion of non-zero elements in a word's co-occurrence vector (Liebscher & Groppe, 2003). To determine the relative number of contexts in which a given word occurs, Audet and Burgess (1999) devised the *context density* measure. Using this measure, abstract words were found to have a significantly greater context density than concrete words. Audet and Burgess contend that this finding "suggests that abstract word representations might have more diffuse connections to associated contextual information" (p.40). The above studies report that learning abstract words are more difficult than concrete words. However, they do not give clear explanations as to why learning abstract words may be more constrained than concrete words other than suggestions, which need to be supported by affirmations based on experimental studies.

2.7 Pre- Receptive to Productive Vocabulary

Researchers have grappled with the idea of how best to describe or define receptive and productive vocabulary and how to reduce the distance or gap between the two (Melka, 2000). In the present study, the concept of *pre-receptive vocabulary* is introduced as a notion of the proficiency of the L2 learner before encountering the word. It also refers to the stage prior to a L2 learner receiving the word for the first time. It is distinct from the belief of word familiarity which has been used to discuss the degrees of knowledge between receptive and productive vocabulary. The present study believes that pre-receptive vocabulary knowledge is an imperative notion that cannot be discounted in L2 vocabulary production.

Melka (2000) explained that the differences between receptive and productive stages are imperceptible and infinite, beginning with the most elementary knowledge such as a first encounter with a word, moving on to visual recognition of the word in a context, its length and so on. The present study draws attention to the pre-receptive vocabulary of the L2 learner as an important factor that determines the type of L2 inferencing strategies employed in reading. Productive knowledge refers to the knowledge of the various meaning of a polysemous word and the knowledge of collocations or idioms (Nagy, 2000). It is assumed that having phonological, morphological, syntactical and lexical information about a word could be considered as productive knowledge. The knowledge must also be grammatical and appropriate (Melka, 2000). The study believes that the learner is engaged in comprehension regardless of the different skills involved in developing vocabulary as proposed by Lado (1961). The L2 learner is believed to be employing appropriate vocabulary learning methods during the processes of reading and comprehension.

Cognitive structures involved in L2 acquisition in general are related to the methods by which the learner's existing linguistic knowledge affects the course of his / her L2 development (Ellis, 1994). Behaviourist theories of L2 learning attribute main

impediments to learning to interference from prior knowledge, and emphasize the idea of difficulty as the amount of effort required to learn a L2 pattern (Ellis, 1994). However, Chomsky's review of Skinner's *Verbal Behaviour* initiated a re-evaluation of many of the central claims (Ellis, 1994). Although there are many models that explain vocabulary behaviour, it is commonly accepted that vocabulary acquisition occurs on a lexeme or lexicon level continuum (Waring, 2002). The fundamental principle behind its acceptance is the fact that as a learner acquires more knowledge of a given word, he/she moves along the continuum of knowledge, in other words, it deems that receptive knowledge of a word comes before productive knowledge (Waring, 2002). Combinations of very different knowledge components as well as learning and production and reception processes are grouped together to define lexical competence (Henriksen, 1999). Vocabulary researchers have used the various scales of vocabulary knowledge to assess the degree of vocabulary knowledge held by learners (Waring, 2002; Scarcella & Zimmerman, 1998).

Various methodologies have been devised to measure the constructs of vocabulary competence, ranging from simple word-recognition tasks (Palmberg, 1989) to more complex tasks that measure differences in the different levels of comprehension (Joe, Nation & Newton, 1997). It is generally accepted that a combination of test formats that tap different aspects of knowledge must be used to measure a learner's lexical competence. Acquiring word meaning is seen as a complex process involving both meaning onto form and network building (Henriksen, 1999). Some recent studies in vocabulary development have reported the effects of receptive and productive vocabulary learning on word knowledge drawing on comparisons of receptive and productive learning (Webb, 2005). However, none to date have focused on the strategies and patterns of vocabulary acquisition or the processes of transition in the mental lexicon of the L2 learner.

Most studies on vocabulary learning based on form and network building are reported from the point of view of L1 vocabulary learning and L2 vocabulary research has overwhelmingly focussed on finding reliable measurements /assessments and neglected the processes or procedures that L2 learners undergo when acquiring

vocabulary. This study provides explanations for the various strategies employed by the L2 learner for comprehension of receptive vocabulary and the processes that are involved in converting that knowledge as productive vocabulary in the mental lexicon.

2.8 Modelling vocabulary acquisition

A model is a detailed description of a process or operation that specifies how the process works (Meara, 2000). Meara (2000) states that the lack of models produced by applied linguists studying vocabulary acquisition has widened the gap between psychologists studying vocabulary acquisition and applied linguists studying vocabulary acquisition. Read (2000) has also highlighted the lack of models to guide the process of vocabulary acquisition in L2 learners. Meara (2000) affirms that a formal model, examining incidental learning on an uptake parameter might provide more knowledge of the processes involved in vocabulary acquisition. This model could then depend on several factors such as vocabulary size of the L2 learner, which involves the learner's prior knowledge which is considered significant in the present thesis. The present study investigates the various strategies employed by the L2 learner to achieve proficiency and creates a model to map the complex procedures. Meara (2000) highlights that research in vocabulary acquisition has been surprisingly silent about the processes by which a learner converts words as part of the mental lexicon.

Meara (2000) pointed out that the models for L1 word acquisition are well-developed (Clarke,1993 as cited in Meara, 2000) but L2 vocabulary acquisition researchers have worked only with loosely held metaphors to illustrate how words are acquired using continua which are transformed into a number of states separated by different thresholds and they are merely descriptive. The lack of explanatory models in L2 vocabulary acquisition calls for the urgent development of efficient models that are competent to explain the complex processes that occur in the mental lexicon for the comprehension and retention of words. The significance of developing such models cannot be denied in this era of global diversity among L2 learners. This knowledge is

vital as it impacts L2 learner classrooms. An analytical model of the conceptual understanding of word comprehension and acquisition in the mental lexicon of the L2 learner is developed in the current study.

2.9 Summary of Chapter

This chapter has reviewed pertinent linguistic theories and vocabulary learning concepts to position the thesis in its context. It has established the outlines of a theoretical framework to the topics being studied, namely L2 inferencing strategies and vocabulary development. It has highlighted some of the underlying gaps in knowledge with regard to inferencing strategies for development of meaning from context and pointed to the lack of L2 models in vocabulary development. It has introduced the notion of pre-receptive vocabulary, a concept unexplored previously in L2 vocabulary research. In addition, the chapter has identified a lack of awareness of the strategies involved for successful comprehension in reading and development of productive vocabulary in L2 learners and drawn attention to the many questions that remain unanswered in the context of L2 vocabulary development.

Chapter 3 will provide a discussion the various types of assessments for measuring L2 vocabulary development and explain the design and development of Criterion referenced tests (CRT) used as both diagnostic and achievement tests.

Chapter-3 Research Paradigms and Methodological Considerations for Developing L2Vocabulary Assessments

This chapter firstly outlines the research paradigms relevant to the study. The validation for the methodological research framework selected is followed by a brief analysis of the educational research and applied linguistics research paradigms and perspectives significant to the study. The rationale for the use of case studies is then provided. The chapter further addresses the issues of validity and reliability in case studies in the context of analysing inferencing strategies and vocabulary development in L2 learners. The chapter sets the scene for Chapter 4 which focuses on the research design, research objectives, and the research questions guiding the objectives, as well as the procedures and methods of research applied in the study.

The present chapter, then, develops a theoretical framework for the development of L2 vocabulary assessments through a review of research studies conducted in second language (L2) learning on receptive and productive vocabulary assessments. A critical examination of the various tasks used for assessing L2 vocabulary informed the design for the most appropriate criterion referenced tests, diagnostic and achievement, for measuring L2 vocabulary proficiency in context in learners. The review demonstrates that context-dependent assessments are scarce and emphasises the need for specialised contextual L2 vocabulary assessment instruments. It focuses on the development and design of context specific vocabulary proficiency tests through an analysis and evaluation of the receptive and productive assessments tasks for measuring L2 vocabulary development.

The methodology for the study is situated in constructivist ontology and interpretive epistemology and is used for the identification of the patterns of inferencing strategies of L2 learners in the first phase of the study. Ontology refers to the study of a group of items that exist or may exist in a domain (Sowa, 2000).The term

ontology is used here with reference to a set of assertions or beliefs about inferencing during reading among L2 learners and L2 vocabulary development in particular. In the study, a constructivist-interpretive paradigm is applied with the assumption that what is being investigated is a product of meanings derived from interactions and understandings of the group being studied. The interpretive epistemological model selected stems from the nature of the research objectives, research questions and investigative processes required for understanding patterns of inferencing and vocabulary strategies employed by L2 learners.

Constructivists apply ontologies that elicit multiple realities in which researchers and participants are able to create their own understandings (von Glaserfeld, 1993). Interpretive patterns assist in guiding and informing inquiry and are described in relation to ontology, epistemology and methodology (Guba & Lincoln, 1994). In a constructivist paradigm, reality is not concrete and therefore the researcher's goal is to construct the understanding of the human experiences and knowledge through which shared reality is created, upheld and transformed.

The study employed a mixed method design to achieve the research objectives outlined in Chapter 4. It applies a case study analysis of the inferencing strategies employed by L2 learners and the influence of teaching explicit inferencing strategies in the development of vocabulary in L2 learners. In Phase One of the study, qualitative methods involving the use of verbal protocol analysis (VPA), or think-aloud procedures, are used to elicit information on the strategies used by L2 learners in developing and acquiring vocabulary. Procedural data analysis from phase one supported the development of a theoretical model of vocabulary development in L2 learners. Phase two of the research involved verifying the validity of the conceptual theoretical L2 vocabulary acquisition model developed and the underpinning proposal for explicit instructional mediation. Two categories of participants comprising of two control groups and two experimental groups took part in the study.

Specially developed vocabulary proficiency pre-tests were administered to multiple groups of participants for measuring vocabulary proficiency prior to selecting identical groups of participants. This was followed by the selection of identical

control and experiment groups for explicit instructional mediation in a constructivist peer learning environment. Quantitative parametric tests such as the *t*-tests assessed the significance of the difference in means between control groups and experimental groups to study the influence of explicit teaching of vocabulary strategies.

3.1 Research paradigms

The study adopts an overarching approach based in Pragmatism which has both phenomenological and ethnographic dimensions. As such it is philosophically grounded in two different interpretive paradigms.

Qualitative research allows for an approach that draws on a number of analytic tools and research methodologies. It has its beginnings in descriptive analysis and is in essence an inductive process, reasoning from a specific situation to a general conclusion (Wiersma & Jurs, 2005; Heigham & Crocker, 2009). The qualitative inquirer is concerned with data that are usually in the form of words that depicts the rich experiences of participants, and additionally collects numeric data to reaffirm the outcomes from initial data gathered (Ary, Jacobs & Razavieh, 2002). The study applies qualitative data gathering methods to investigate L2 inferencing strategies and draws upon quantitative experimental methods to authenticate the role of explicit teaching of these strategies.

Putney and Green (1999) point out that qualitative approaches have provided ways of transcribing and analysing the consequential nature of learning within events and provide insights to the researcher in academically appropriate ways. The qualitative methods of research used in this study are cogent in the development of instructional practices and the study posits the significance of explicit instructional mediation for the development of vocabulary in L2 learners.

The sections below explain the rationale for the selection of several qualitative traditions as well as quantitative methods of research which are well established in educational and applied linguistics research and document ways in which these different research traditions have shaped the research methodology for the study.

3.2 Research methods in Education & Applied Linguistics

As the study is positioned in educational linguistics and applied linguistics, the methodology and approaches employed in the study adhered to the procedures called for in educational research. In educational research, methodology is critical for a meaningful realisation of research results (Wiersma & Jurs, 2005).

As Richardt and Cook (1979 as cited in Nunan, 1992) amongst many others argue, researchers in language studies research do not follow the principles of a theoretical paradigm without assuming methods and values of the alternative paradigms. In the present study a mixed-method research design was selected to ensure the rigorous procedures required in order to achieve valid outcomes. Grotjahn (1987) states that research traditions in applied linguistics must take into account the methods used for data collection, such as: if the data was collected experimentally or non-experimentally; if the type of data elicited by the investigation is qualitative or quantitative; and, if the type of analysis conducted on the data is statistical or interpretive. Nunan (1992) says that mixing these methods provides the researcher with two "pure" research paradigms such as an "exploratory-interpretive" paradigm which uses a non-experimental method, yields qualitative data about it and provides an interpretive analysis. The first Phase of the study, which is qualitative, generated rich descriptions and data leading to theoretical interpretations. In the second Phase an "analytical-nomological" approach was used in which data are collected through experiments and yielded quantitative data which were subjected to statistical analysis as advocated by Nunan (1992). The second Phase of the study employed quantitative methods consistent with research methods in education to confirm the formulation of a L2 vocabulary development model in tertiary learners.

Stringer (2004) states that while there are distinctive differences between qualitative research and quantitative methods, it is possible to use qualitative methods to obtain and partly analyse data in experimental studies, and that it is possible to apply quantitative data within a qualitative study to clarify emerging perspectives.

For the present study, the research design demands both the qualititative-interpretive paradigm that yield qualitative data analysed interpretively, and the experimental design that use experiments through which vocabulary proficiency are measured and supported statistically. In the first phase, the research focussed on investigating the patterns in inferencing strategies in L2 learners at a tertiary level through qualitative methods such as Verbal Protocol Analysis (VPA). Theoretical analysis of this data informed the conceptualisation of a specific model of L2 vocabulary development model. Data collection and analysis is a frequent development in qualitative research and the early insights and tentative perceptions directed the next phase of data collection which in turn lead to the refinement of the research objectives. Qualitative inquiry demonstrates significance for context and presumes human behavior as context-bound and thus the inquiry is always bounded by a particular context (Merriam, 1998; Ary, Jacobs & Razavieh, 2002). In the present study the inferencing strategies and the development of vocabulary is focussed in a specific category of tertiary L2 learners who came from a first year undergraduate engineering course.

3.2.1 Rationale for the use of Case Studies

As a philosophical underpinning for mixed-methods studies, Tashakkori and Teddlie (1998) and Patton (1990) underscored the importance of focussed direction on the research problem in social science research and pluralistic approaches to obtain knowledge about the problem (as cited in Creswell, 2003). The fact that this study intentionally draws on a number of research traditions and tools is, a valid decision. Searle (1999, p.9) argued that there should be such a 'flexible and pragmatic relationship between research practice and methodology'. In addition, such a multi-method response demonstrates commitment to the criteria of appropriacy and rejects a

'best method'. The multi-method approach is essential for the present study in order to authenticate the investigation and evaluation of the data gathered.

It is well established that qualitative methods such as case studies can be used first for strong internal validity followed by quantitative methods to establish external validity or generalisability in order to provide a more insightful understanding of the phenomena being investigated (Yin, 1994). Bassey (as cited in Opie, 2004: 5) draws a distinction between 'open' generalizations where 'there is confidence that it can be extrapolated beyond the observed results of the sets of events studied, to similar events' and 'closed' generalisations 'which refers to a specific set of events and without extrapolation to similar events' which Bassey refers to as 'relatability'. Relatability is defined as how a phenomenon closely resembles what happens in another similar educational setting (Opie, 2004). The research outcomes from the present research studies claim relatability.

Yin (1994) proposed that for case study analysis the dominant modes of data analysis are:

a) The search for patterns by comparing results with patterns from literature or theory; and
b) Explanation building in which the researcher looks for causal links or explores plausible rival explanations and attempts to build explanations about the case.

For this study, the above two guidelines were applied. The first Phase involved investigating the data for patterns of inferencing strategies employed, and explanation building was conducted through developing theoretical units of analysis from the data gathered. The goal in a case study is to arrive at a detailed description and understanding of the bounded unit (Ary, Jacobs& Razavieh, 2002). In the present context, the investigative study focuses on the development of English (L2) vocabulary in a specific group of tertiary learners with Malay/ Chinese L1.

Adelman et al. (1976, as cited in Nunan, 1992) argue that the understandings created by case studies are important in their own right and that case studies allow for theory building via tentative hypotheses gathered from the accumulation of single instances. For the present study, the researcher has attempted to derive theoretical assumptions from the data gathered. The researcher can select an instance from the class of objects and phenomena one is exploring, and investigate the way this instance functions in context (Adelman et.al., 1976 as cited in Nunan 1992), for example in L2 learning, one can focus on the acquiring of vocabulary. The focus of the present study is L2 vocabulary development. Case studies may resemble ethnography in their philosophy, methods and concern for studying phenomena in context but unlike ethnography, case studies can employ qualitative and quantitative and statistical methods (Nunan, 1992). Yin's definition of case studies (1994) is considered most suitable for this study.

"[A] case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used"(Yin 1994,p.23) .

3.2.2 Reliability and Validity in Case Studies

Validity has been defined as not a single, fixed or universal concept but as a reliant construct that is grounded in the processes or intentions of particular research methodologies (Winter, 2004). Internal validity deals with how research findings match reality and connects to the credibility of the outcomes and the construal based on the theoretical fundamentals and evidence provided (Duff, 2007). Merriam (1998) offers various strategies to enhance internal validity. Triangulation involves using multiple sources of data or multiple methods to confirm the emerging data. The study focussed on knowledge of procedures by which L2 learners convert receptive vocabulary into productive vocabulary and make them part of their mental lexicon. Through a triangulation of data obtained through both concurrent and retrospective

verbal protocol, a methodical understanding of the phenomenon investigated is achieved.

Reliability in a research design is often believed by some researchers to be based on the assumption that there is a single reality and that studying it repeatedly may yield the same results. However, the processes studied in Education and in Humanities in general are multi-faceted and highly contextual and "because the emergent design of a qualitative case study precludes a priori controls", it is difficult if not impossible to achieve reliability but, it can be assessed through various techniques of analysis and triangulation (Merriam, 1998: 206). The study is premised in a highly contextual and complex background of L2 vocabulary development. It is believed that with specific procedures for coding and analysis of elicited verbal protocol and with the use of suitable instruments for measuring vocabulary proficiency the validity and generalisability of the study is enhanced. In social constructivism often combined with interpretivism (Mertens, 1998 as cited in Creswell, 2003) assumptions are that individuals seek understanding of the world they live and work in and develop subjective meanings of their experiences (Creswell, 2003). These meanings are varied and multiple and lead the researcher to look for complexity of views by gathering as much as possible the participants' views of the phenomenon being studied. Subsequently, constructivist researchers often address the "processes" of interaction among individuals and also recognise that their own background shapes the interpretation and also generate or develop patterns of meaning (Creswell, 2003). The current study attempted to gather meaningful data in the form of verbal protocol for a relevant interpretation of inferring strategies employed in reading activities.

Precision is enhanced by a series of triangulation techniques (Mathison, 1988) at the data source level, the data collection level and the data analysis level (Patton, 1990). This was made possible in the present study through the collection of both qualitative and quantitative data from the first and second phase of the study so that data from one source complement the data from the other source. The influence of explicit teaching instruction and levels of vocabulary development is measured through the use of specifically developed CRT tests (achievement L2 vocabulary measurement instruments).

The next section explains the rationale for the development of specific criterion-referenced vocabulary proficiency tests both diagnostic and achievement that measures vocabulary proficiency in context through a review of relevant literature.

3.3 Assessment Tasks for Receptive and Productive Vocabulary

A literature review central to the constructs of vocabulary assessment tasks entail that any task one applies for measuring the depth of receptive or productive vocabulary, be able to reflect on developmental patterns (Waring, 1999). The terms receptive and productive vocabulary is used extensively in language studies and Psychology. One of the early vocabulary researchers, Myers (1914 as cited in Waring, 1999) tested recognition and recall memories for words in the form of simple tests. The procedure Myers followed was to initially give respondents a list of 20 words as a spelling test and after half an hour the respondents received a surprise recall test, followed by a recognition test of the 20 words mixed in with distorter words. Myers (1914, as cited in Waring, 1999) found that there was a disproportion between the recognition and recall memories for words, in that the respondents were able to recognise words better than recall them.

The present study investigates the processes involved and the range of inferencing strategies employed in L2 learners to proceed from a *pre-receptive* to productive stage of vocabulary development. Smith and Prescott (1942) specified that receptive language skills of listening and reading were passive skills because the learner was not doing much in terms of comprehension of language. This belief was commonly held then. The skills of speaking and writing were thought to involve active creation of language and were classified under active skills. Lado's (1961) pioneering book, *Language Testing*, suggested that the learner is engaged in comprehension regardless of the different skills involved. Researchers came to accept that recognition tested receptive knowledge while recall tested productive knowledge. However,

huge variations exist currently among researchers on definitions regarding receptive and productive vocabulary and how they must be tested.

Recognition and recall vocabularies are generally referred to as the product of the mental operations involved in the completion of a task (Waring, 1999). In the study conducted by Myers (1914 as cited in Waring, 1999), a test of recognition of vocabulary is one that has been structured with the view to present the learner with a set of choices from which she is to select the suitable option. Cronbach, 1942; Nation, 1990; Laufer & Nation, 1995; Bachman and Palmer 1996; Waring, 1999, and Wagner, Muse and Tannenbaum, 2006, among others have recognised the importance of assessing vocabulary on a multi-dimensional scale.

The present study emphasises the importance of testing L2 vocabulary proficiency in context and has attempted to develop CRT- diagnostic/ achievements tests to measure a range of lexical knowledge. Cronbach (1942) distinguishes five aspects of lexical knowledge: generalisation (knowing the definition), application (knowledge about use), breadth of meaning (knowing different senses of a word), precision of meaning (knowing how to use the word in different situations) and availability (knowing how to use the word productively).

Nation (1990) puts forward four scales of lexical knowledge: form (oral or written), position (grammar and collocations), function (frequency and appropriateness) and meaning (conceptual and associative). All these forms of knowledge can be receptive or productive. Bachman and Palmer (1996) propose that the general construct underpinning language testing involve testing multiple areas of knowledge and competence. The present study develops a vocabulary proficiency instrument in context that measures breadth of meaning (knowing different senses of a word), depth of meaning and precision of meaning (knowing how to use the word in different situations) and vocabulary production. The study believes that the development of vocabulary is inherently complex in nature and can be assumed to be incremental where

learners require mastery of strategies to deal with comprehension prior to vocabulary knowledge becoming productive.

Waring (1999) postulates that multiple-choice tests and matching tests are standard ways of carrying out measurement of vocabulary. Vocabulary assessment in the history of the twentieth century is associated with the development of objective testing (Read, 2000). There appears to be a high correlation between tests of vocabulary and reading comprehension in both first language assessment studies (Anderson & Freebody , 1981) and second language assessments studies(Pike, 1979). Waring (1999) defines the Receptive- Productive vocabulary product as:

" [I]t is likely that there is an underlying knowledge of words which is mediated by the mental processes of receiving and producing language. The Receptive and Productive vocabulary product (the test score) is probably the result of the interaction between the mental processes of reception and production and the underlying word knowledge. The degree of control one has over the interaction between the processes and the underlying word knowledge may also reflect the surface Receptive and Productive vocabulary product….Thus, performance on a test is a function of one's underlying knowledge and one's ability to control what happens in the Receptive and Production mental processes" (Waring, 1999, p.15).

Wide ranges of test items and methods have been used for measuring vocabulary proficiency. According to Read (2000) discrete vocabulary tests that are selective and context independent may be deemed sufficient measures of vocabulary knowledge, but at the same time the author (Read, 2000) stated that it is difficult to establish if they are not much different from tests of grammar. The present study has designed criterion referenced tests CRT-diagnostic/achievement tests which assess L2 vocabulary in context through appropriate reading texts. Assessing vocabulary knowledge is manifold and one needs to select plausible materials and adequate procedures to gain valid and reliable results. A variety of tests are required to address diverse as-

pects of the lexicon (Bogaards, 2000). The creation of suitable vocabulary assessment tests has been made complex due to the lack of clear definition of what constitutes a 'word'. Brown and Miller (1992) state that if we accept the sentence as an abstract unit set up by linguists that we can assume that words are patterns formed within sentences that are dependent upon each other. The term 'word' has not been an easy concept to define, both for theoretical and for applied purposes (Read, 2000). This belief is reiterated by researchers such as Bogaards (2000) who states that the term 'word' has never been clarified in linguistic theory though, many definitions have been provided for the various aspects of lexical units.

3.4 Vocabulary Tests

Two important measures taken in the study are integral for the validation of the conceptual model of L2 vocabulary development created through the study. Firstly, it was necessary to design a context specific vocabulary proficiency instrument for measuring the prior knowledge and vocabulary proficiency in all the participant groups (experimental and control groups), referred to in study as the *pre-receptive* vocabulary of L2 learners. Secondly, it was also important to ascertain if any vocabulary gains were achieved through the explicit teaching of strategies to experimental groups.

Numerous vocabulary studies have focused their attention on the creation of efficient instruments that are capable of measuring vocabulary knowledge. Tasks are often used in experimental research in order to elicit performance data from subjects. Because they are believed to be controllable and measurable, tasks have earned the status of a constant in research design (Coughlin & Duff, 1994).

The Vocabulary Levels Test (Nation, 1983; 1990) was carried out in the early 1980s, at the Victoria University of Wellington, in New Zealand as an instrument for classroom use by teachers in order to assist in the development of a suitable vocabulary teaching and learning programme. It proved to be a useful diagnostic tool for testing vocabulary knowledge of international students when they arrived at a sec-

ondary school in an English speaking country. Vocabulary researchers like Meara (1996) have endorsed this test. The test involves word-definition matching from a range of 2000-3000 word levels that contain the high-frequency words that all learners are required to know for English competence and word-definition matching in 10,000 or more common lower frequency words in English.

Figure.3.1 Test Items from the vocabulary levels test (Nation, 1990)

1 apply

2 elect - choose by voting

3 jump- become like water

4 manufacture- make

5 melt

6 threaten

The items in the vocabulary levels test are found to have high levels of Guttmann Scalability and therefore establish some degree of validity (Read, 2000). However, they are discrete tests and do not test vocabulary in context. Many L2 vocabulary researchers recommend that word knowledge be assessed in the domain and context of reading (Read, 1997, 2000; Wagner, Muse & Tannenbaum, 2006).

Laufer and Nation (1995) developed a newer version of the vocabulary levels test by Nation (1990) with similar target words, but instead of matching words and definitions, the test takers need to write the missing target words in a set of sentences. This blank filling version was used to provide evidence for the lexical frequency profile (LFP) test. This test item requires more word knowledge and more use of contextual information indicating that it might be a more efficient test of vocabulary knowledge.

Figure 3.2 Sample Items from the vocabulary levels test (Laufer & Nation, 1995).

The picture looks nice; the colours bl…….. really well.

Nuts and vegetables are considered who…… food.

Scientists are worried about the amount of colo…. in our food nowadays.

In the vocabulary size test of controlled productive ability (Laufer & Nation, 1999), learners at higher levels of proficiency scored higher than lower proficiency learners did. But, this information does not provide any explanation in connection to the meaning of the test scores.

Schmitt's (1998) studies focused on the acquisitional process and development of a hierarchy of word knowledge. Four kinds of word knowledge were measured (spelling, associations, grammatical information and meaning) over the period of a year for 11 polysemous words. For each word, the participant was asked to:

a) to spell the word
b) to 'give the first 3 words you think of when you hear the word_____'
c) the word class of the word (with subsequent prompts for other word class forms)
d) to explain any meaning they knew for the words (if the participant gave illustrations, it was accepted).

If meaning of a word of a word was given unaided by a respondent, this was taken to demonstrate productive knowledge, however, if the meaning was given with prompts it was taken to illustrate receptive knowledge. However, knowing the definitions of words alone does not constitute productive vocabulary knowledge as has been established in vocabulary research. Productive vocabulary knowledge requires learners to have knowledge of the use of words, demonstrate breadth and precision of meaning and knowledge of situations in which the words can be used, among other things. Vocabulary research has also emphasised multi-dimensional scale of

testing for establishing vocabulary proficiency (Cronbach, 1942; Nation, 1990; Laufer & Nation, 1995; Bachman and Palmer 1996; Waring, 1999 and Wagner, Muse & Tannenbaum, 2006).

Schmitt (1998) employed oral reporting procedures for the word knowledge test. Waring (1999) states that the lack of ability to express oneself in a foreign language could withhold the display of actual knowledge. Over the period of the study, Schmitt (1998) did not find any developmental sequence for word knowledge types as many of the words stayed in the same state (either unknown, receptive or productive).

The vocabulary knowledge scale test was first initiated by Wesche & Paribhakth (1996) and they presented the following list of characteristics.

Figure 3.3 List of characteristics on the vocabulary knowledge scale (Wesche & Paribakth, 1996: 15)

1.   how target vocabulary items are selected;

2.   the nature of the task presented to the testee;

3.   the test response format used;

4.   criteria for judging open-ended responses.

Wesche & Paribhakth (1996) also list twelve different types of formats that can be used to evaluate the size and breadth of vocabulary knowledge. The vocabulary knowledge scale consists of two scales: one for eliciting responses from the respondents and one for scoring the responses. Paribhakth and Wesche (1997: 179-180) give four steps or categories, for each word on the list, for which the test-takers or respondents are asked to decide which category best represents how well they know the word.

Figure 3.4 The VKS elicitation scale (Paribhakth & Wesche, 1997: 180)

Self-report categories

1. I don't remember having seen this word before.

2. I have seen this word before, but I don't know what it means.

3. I have seen this word before, and I <u>think</u> it means _____ (synonym or translation)

4. I know this word. It means

The scoring scale given below transfers the responses to each word into test scores.

Figure 3.5 The VKS scoring categories (Paribhakth & Wesche, 1997, p. 181)

Self-report categories	Possible scores	Meaning of scores
1.	1	The word is not familiar at all.
2.	2	The word is familiar but its meaning is unknown.
3.	3	A correct synonym or translation given.
4.	4	The word is used with semantic appropriateness in a sentence.
5.	5	The word is used with semantic appropriateness and grammatical accuracy in a sentence.
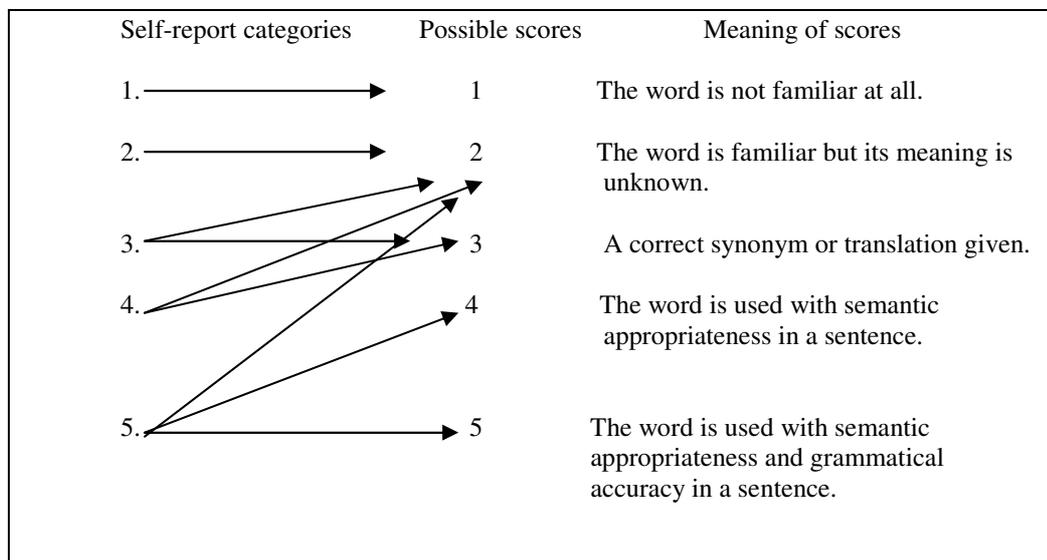
The reliability of the VKS test seems to be fairly high as reported by Paribhakth & Wesche, (1997). They recorded a high correlation (0.92 to 0.97) between the way the students rated themselves on the elicitation scale and the way their responses were scored which showed reasonable accuracy between the way the stu-

dents rated themselves and the way they scored. However, this test does not measure multiple meanings of the word. Bogaards (2000) emphasises the measurement of knowledge of polysemous words and collocations in addition to size and breadth of lexical knowledge for advanced learners. Meara (1996) states that beyond the limit of 5,000 or 6,000 words for English it is important to measure other dimensions. The current vocabulary tests measure vocabulary proficiency of L2 learners at a tertiary level of education.

Multiple choice vocabulary tests, though widely used in assessing vocabulary, have also attracted much criticism regarding its usage. (Meara & Buxton, 1987; Wesche & Paribhakth,1996). Successfully completing a multiple-choice item is mentally challenging, according to Waring (1999). For example, in order to correctly answer a multiple-choice item, the respondent needs to identify the form and match the form with an entry in the mental lexicon. There is also the process of retrieval and matching process that involves paradigmatic or syntagmatic associations (Waring, 1999).

Wesche and Paribhakth (1996:17) cite various criticisms for the implementation of multiple-choice tasks, such as:

1. Difficulty in constructing them and requiring field- testing and analysis.
2. The learner may know another meaning for the word, but not the one sought.
3. The learner may choose the right word by a process of elimination, and has in any case a 25 percent chance of guessing the correct answers in a four-alternative choice.
4. Items may test students' knowledge of distractors rather than their ability to identify an exact meaning of the target word.
5. The learner may miss an item either for lack of knowledge of words or lack of understanding of syntax in the distractors.
6. This format permits only a very limited sampling of the learner's total vocabulary.

However, the authors (Wesche & Paribhakth, 1996) agree that multiple-choice is popular with test developers because it is easily administered and there are well-established procedures for analyzing them. Multiple-choice cloze tests have also been used by Hale, Stansfield, Rock, Hicks, Butler and Oller (1988) in tests of English as a foreign language. The standard type of cloze test is assumed to require writing ability (Porter, 1976) whereas the multiple-choice version is more of a measure of reading ability (Read, 2000). One of the main problems of constructing vocabulary tests is the absence of standards (Bogaards, 2000). According to Wesche & Paribhakth (1996: 14)

"[t]here is a lack of agreement among theoreticians, researchers and questionnaire respondents about what it means to know a word and that there is a lack of theoretical consensus about the nature and course of development of L2 vocabulary knowledge, and lack of alternative instruments that aim to measure the level of knowledge of individual words which makes it difficult to estimate concurrent validity".

The present study endeavours to design vocabulary measuring instruments that assess L2 vocabulary proficiency in context using reading texts.

3.5 Cognitive Processes in Vocabulary Development

Cognitive psychological researchers have identified five basic memory stages in vocabulary development: acquisition, registration, storage, access and transfer (Baddley, 1997). The process of acquisition consists of input and selective intake. Baddley (1997) points out that learners encountering unknown lexical items use the strategy of coding items either phonetically or semantically. In semantic coding, the

learner matches the meaning of the word with the particular significance it conveys (Combs, 2004). There is always some tension between the construct, the theory and the test format and it is recommended that the construct be operationalised in the best way possible (Waring, 1999).

Waring (1999) outlines the definition of the terms recognition and recall as both test formats (a recognition test or recall test) and mental processes (the process of recognition and the process of recall). Waring (1999) describes a 'recognition test' as those that require a respondent to select or recognize (the mental process) the target from a list of given choices as in a multiple choice test or a matching test and a 'recall test' as one that requires the participant to recall (the mental process) previously learned material. According to Waring (1999) tests of active vocabulary are usually sentence or word completion, essay writing or L1 to L2 translation.

Researchers such as Henriksen (1996) refer to a continuum along which a language develops, or a hierarchical order of conceptualisation which has levels such as a partial precise continuum or knowledge continuum where the word knowledge is tested at different levels of comprehension, and a receptive-productive continuum which describes the different levels of ability through different receptive and productive tasks, and a depth of knowledge continuum that deals with knowledge of paradigmatic and syntagmatic relationships of words. Henriksen and Haastrup (1998) suggest that there are various tasks that could measure word knowledge along the partial precise continuum. However, it is difficult to identify the different kinds of knowledge through tasks that reflect varying degrees of difficulty.

Waring (1999) proposes a multi-state model assessment as a framework for assessing receptive and productive vocabulary. He states that meta-cognitive knowledge is necessary for learners to report on their ability of vocabulary knowledge. Meta-cognition can be defined as thinking about thinking. Learners who are meta-cognitively aware have strategies for finding out or figuring out what they need to do. The use of meta-cognitive strategies ignites one's thinking and can lead to more profound learning (Anderson, 2002).

The state rating task (SRT) is a test (see figure 3.6) where the learner is required to rate a set of words from a set of knowledge states in which the learner is given a rubric that identifies a certain number of states (Waring, 1999).

Figure 3.6 An example of SRT test (Waring, 1999: 10)

Circle each word below with the number that best corresponds to one of the following

1. I do not understand this word.
2. I understand this word quite well.
3. I understand this word well.
4. I understand this word very well.

Swallow	0	1	2	3
Instinct	0	1	2	3
Vary	0	1	2	3
Affluent	0	1	2	3

Waring (1999) emphasises that the SRT can vary from being a linear task given in Figure 6. to one that is progressional or uses two separate scales of knowledge for two different aspects of word knowledge. Figure 3.7 shows how two ratings can be given in a SRT test.

Figure 3.7 An SRT with two scales (Waring, 1999: 11)

Circle each word the number that best corresponds to ONE of the following on each of the two scales

0 I do not understand this word	0 I cannot use this word
1 I understand this word quite well	1 I can use this word quite well
2 I understand this word well	2 I can use this word well
3 I understand this word very well	3 I can use this word very well
Understanding	Use

Swallow	0	1	2	3					Swallow	0	1	2	3
Instinct	0	1	2	3					Instinct	0	1	2	3
Vary	0	1	2	3					Vary	0	1	2	3
Affluent	0	1	2	3					Affluent	0	1	2	3

Waring (1999) claims that there are several advantages to an SRT test with two scales, in that the respondent can rate her knowledge against 4 understanding scales and 4 use scales. There is also the ability of SRTs to record changes over time using a single measure and to find individual development patterns. However, there could be problems arising with reporting reliably, but Waring (1999) suggests that giving a SRT to some learners and then giving them an objective test such as a translation test, could verify that the respondent in fact knows this knowledge. Although the SRT test could trace the L2 learners' aptitude to use a particular word over time to record developmental patterns, it is a discrete test and tests vocabulary proficiency in isolation and therefore are distant from the domains of reading and context. The vocabulary tests designed in the present study are contextual in nature based on reading texts and are more reflective of L2 learning tasks that develop proficiency. It has been well established (Coughlin & Duff, 1994) that tasks are often used in experimental research in order to elicit performance data from subjects as they are believed to be controllable and measurable, and have earned the status of a constant in research design. The current vocabulary tests have been developed through reading tasks which tests vocabulary in context.

Table 3.1 shows a summary and critique of the existing tests for measuring vocabulary proficiency.

3.1 Table of Review of Assessment Tasks for Measuring Vocabulary Proficiency

Existing Model	Process	Comments
Myers (1914) tested recognition and recall memories for words in the form of simple tests	The respondents were given a list of 20 words as a spelling test and after half an hour the respondents received a surprise recall test, followed by a recognition test of the 20 words mixed in with distorter words	Myers (1914) found that there was a disproportion between the recognition and recall memories for words, in that the respondents were better able to recognize words than recall them. *Not suitable for current study as it is a discrete test*
Cronbach (1942) five aspects of lexical knowledge: generalization (knowing the definition), application (knowledge about use), breadth of meaning (knowing different senses of a word), precision of meaning (knowing how to use the word in different situations) and availability (knowing how to use the word productively)	All these forms of knowledge can be receptive or productive	*The general construct underpinning language testing involve testing multiple areas of knowledge and competence.* *Guidelines suggested here are suitable for the present study which tests vocabulary in context*
Nation (1990) puts forward four scales of lexical knowledge: form (oral or written), position (grammar and collocations), function (frequency and appropriateness) and meaning (conceptual and associative).	Recognition and retention	*Vocabulary knowledge is very complex, requires strategies for production.* *Tests must be contextualized.*
Waring (1999) postulates that multiple-choice tests and matching tests are standard ways of carrying out measurement of vocabulary.	Vocabulary assessment and objective testing linked	*More complex testing is necessary for measuring proficiency in current study*
Read (2000)Discrete vocabulary tests that are selective and context independent could be deemed as sufficient measures of vocabulary knowledge.	Sometimes it is difficult to establish if they are not much different from tests of grammar.	*Not suitable as the present study which focusses on contextual lexical clues and context dependent proficiency*
The Vocabulary Levels Test (Nation, 1983; 1990) was carried out in the early 1980s, at the Victoria University of Wellington, in New Zealand as an instrument for classroom use by teachers in order to assist in the development of a suitable vocabulary teaching and learning programme.	The test involves word-definition matching from a range of 2000-3000 word levels that contain the high-frequency words that all learners are required to know for English competence and word-definition matching in 10,000 or more common lower frequency words in English\n\nThe items in the vocabulary levels test are found to have high levels of Guttmann Scalability and therefore	*Matching words to definitions does not provide the researcher with knowledge on depth of vocabulary proficiency*\n\n\n\n*(Table continued overleaf)*

	establish some degree of validity (Read, 2000).	
Laufer and Nation (1995) developed a newer version of the test with similar target words, but instead of matching words and definitions, the test takers need to write the missing target words in a set of sentences.	This blank filling version was used to provide evidence for the lexical frequency profile (LFP) test. This test item requires more word knowledge and more use of contextual information indicating that it might be a more efficient test of vocabulary knowledge.	*This method is more suitable if tested in context and not as discrete tests*
Wesche & Paribhakth (1996) list twelve different types of formats that can be used to evaluate the size and breadth of vocabulary knowledge. The vocabulary knowledge scale consists of two scales: one for eliciting responses from the respondents and one for scoring the responses.	Paribhakth and Wesche (1997: 179-180) give five steps or categories, for each word on the list, for which the test-takers or respondents are asked to decide which category best represents how well they know the word	*This test is not suitable for the current study*
Multiple choice vocabulary tests, though widely used in assessing vocabulary, have also attracted much criticism regarding its usage. (Refer to Meara and Buxton (1987) and Wesche and Paribhakth ,(1996). Successfully completing a multiple-choice item is mentally challenging, according to Waring (1999).	In order to correctly answer a multiple-choice item, the respondent needs to identify the form and match the form with an entry in the mental lexicon. There is also the process of retrieval and matching process that involves paradigmatic or syntagmatic associations (Waring, 1999).(Wesche &Paribhakth 1996: 17) cite various criticisms for the implementation of multiple-choice tasks.	*Multiple-choice tests for words in context is suitable for present study, however the words must assess proficiency in context.*
According to Waring (1999) tests of active vocabulary are usually sentence or word completion, essay writing or L1 to L2 translation.		*The task is suitable for testing words in context.*
Waring (1999) proposes a multi-state model assessment as a framework for assessing receptive and productive vocabulary. He states that meta-cognitive knowledge is necessary for learners to report on their ability of vocabulary knowledge.	Learners who are meta-cognitively aware have strategies for finding out or figuring out what they need to do. The use of meta-cognitive strategies ignites one's thinking and can lead to more profound learning (Anderson, 2002).	*A test involving meta cognitive strategies and one that tests vocabulary knowledge in context will be more appropriate.*

3.6 Test Design

The test design for the present vocabulary proficiency test draws from a criterion-referenced test model. Brown and Hudson (2002:5) defines a criterion-referenced test as a test that is primarily designed to describe the performances of ex-

aminees in terms of the amount that they know of a specific domain of knowledge or set objectives. A criterion- referenced type of test or (CRT) was chosen as the basis for the test design as the scores would indicate individual vocabulary proficiency of the study participants at the time of the test. CRTs are able to find out how much students know before instruction begins and after it has finished (Popham, 1975 as cited in Huitt, 1996).

In order to analyse the role of teaching explicit strategies in the development of vocabulary in L2 tertiary learners in the study, initial (CRT- diagnostic type) pre-test vocabulary measurement tests need to be administered to measure the current vocabulary proficiency level in English of the L2 learners in participant groups, and to assist in determining the uniformity of the participant groups. The strength and purpose of CRT-type tests is that they allow the researcher to classify test takers according to whether they are able to perform some tasks or sets of tasks satisfactorily and provide direct information (Hughes, 1999). In this study, the CRT tests measure the vocabulary proficiency of the test takers. Similar criterion referenced (achievement type) tests are administered at the end of the course in control and experimental groups of participants to measure vocabulary achievements, if any.

3.7 Test Construction

Studies conducted by vocabulary researchers show that reading comprehension tests and vocabulary tests are highly correlated in first language assessment studies (Anderson & Freebody,1981) and second language (L2) assessments studies (Pike, 1979). Vocabulary proficiency is highly correlated with reading comprehension (Baker, Simmons, & Kame'enui, 1995; Kuhn & Stahl, 1998; Stahl & Fairbanks, 1986; Stanovich, 1986). CRT tests are able to determine whether a student possesses specific skills or knowledge (Huitt, 1996). The present CRT- diagnostic type tests to be administered at the beginning of the course are designed to measure vocabulary knowledge in scientific or engineering contexts in first year undergraduate studies and are based on four reading texts. (see Appendix 4.1, Appendix 4.2, Appendix 4.3 and Appendix 4.4)). Multiple texts were selected for relevant content areas and for testing a range of appropriate vocabulary items. The tests measure contextualised lexical

meanings as recommended by Weir, Yang & Jin (2000) for both receptive and productive vocabulary knowledge and vocabulary depth knowledge, authenticating a comprehensive vocabulary skill profiling of the test participants. A total of four pre and post tests were designed so that a sufficient number of test items could be selected from context. A total number of 53 content words were selected from context for measuring receptive vocabulary skills, vocabulary depth and productive vocabulary skills. Spolsky (1994 as cited in Weir, Yang & Jin 2000) recommends using a variety of reading assessment measures in order to be able to account for multiple aspects of proficiency.

Other well-known tests such as Advanced English Reading Test (AERT, Weir, Huizhong and Yan, 2000) conducted in Chinese Universities and at CALS, University of Reading, used around 42 items to test the students' ability to comprehend academic texts and to extract important information from the texts. While the AERT is not specifically a vocabulary test, it tests readers in context. Other professional English language competency tests such as IELTS and TOEFL tests vocabulary skills more inclusively on language skills with less than 50 items. It is believed that 53 items in the current tests provide a reasonable measure of the range of vocabulary skills tested.

Cronbach, 1942; Nation, 1990; Laufer & Nation, 1995; Bachman and Palmer 1996; and Waring, 1999, among others have emphasised the importance of assessing vocabulary on a multi-dimensional scale. Word knowledge was traditionally assessed in a decontextualised, dichotomous fashion (Wagner, Muse & Tannenbaum, 2006). However what it means to know a word cannot be measured without taking into account the domain and context of reading. The CRT- diagnostic pre-tests for measuring vocabulary proficiency attempt to measure a range of lexical knowledge such as generalisation in domain (knowing the definition). This is important because defining a word in context relates to knowledge of linguistic semantics in context. In reading each sentence, definitions and contexts carry crucial roles, and must be examined in order to assess the reader's vocabulary proficiency. Context and definition combine and contribute most to reading comprehension (Crist, 2007). The tests measure application of lexical information gathered from the texts (knowledge about use)

through tasks such as explaining meaning of technical vocabulary in context, in short sentences.

Vocabulary researchers (Singleton, 1999; Lewis, 2000; Hunt & Beglar 2005) have acknowledged the significance of the lexicon as a measure of being able to learn to learn and use a language. The notion of vocabulary knowledge, in particular, lexical competence has been the centre of scholarly investigations (Pavlenko, 1999; Singleton, 1999; Nation 2005), and the breadth and depth of lexical competence has been emphasised by other researchers (Wesche & Paribakth, 1996; Laufer & Goldstein, 2004; Nation, 2005). The tests analyse breadth of meaning (knowing different senses of a word) and precision of meaning (knowing how to use the word in different situations) through summary reading tasks and tasks that require accurate selection of words for sentence completion.

Mohseni-Far (2008) argues that the difference between knowing a word and using a word is one way to study the task of vocabulary learning. Beck, McKeown & Omanson's (1987) final stage in the continuum of word knowledge refers to decontextualised knowledge of a word's meaning, its relationship to other words, and its extension to metaphorical uses. While knowledge of a word's meaning and its relationship to other words are important in a general sense, it poses limitations on the ability of the word to context-sensitive meanings. The present CRT diagnostic tests measure the ability of the reader to use context to determine the meaning of words and the study participants' level of vocabulary proficiency. Similar criterion referenced achievement post-tests in control and experimental groups of study participants are administered in order to measure vocabulary gains (if any) in experimental groups where specific instruction of vocabulary learning is conducted and for comparison to the performance in vocabulary tests by control groups where standard vocabulary instruction will be carried out by experienced colleagues .

Waring (1999) claims, that meta-cognitive knowledge is necessary for learners to be able to report on their vocabulary knowledge proficiency. Additional self-reports gathered from study participants through retrospective verbal protocol on vocabulary learning strategies employed provide further information on study partici-

pants' meta-cognitive knowledge competence. Davis (1968) documented five skills of reading: identifying word meaning; drawing inferences, identifying a writer's techniques and recognising the mood of the passage, and finding answers to the questions asked explicitly or in paraphrase. Weir & Porter (1996) identified vocabulary proficiency as a second factor that contributes to reading competence.

In studies in English as a Foreign Language (EFL) it is established that background knowledge plays a role in demonstrating reading ability. Bernhardt (1991, as cited in Weir, Yang and Yan, 2000) maintains that in L2 reading, both language features and textual features are perceived as elements, whereas knowledge elements included in the text are not easily observed. Weir, Yang and Yan's (2000) review of studies in background knowledge effect on EFL reading summarises a few points that researchers should be aware of. The authors (Weir, Yang, & Yin, 2000) refer to readers' schematic knowledge, especially content and formal knowledge, which they say affect how and which skills or strategies are used. Schematic knowledge is related to background knowledge and provides a framework for readers to connect to incoming text information.L2 vocabulary research establishes that the path to L2 vocabulary acquisition is complicated and complex and for comprehension to occur learners need to know at least 95 % of the words in the text at any level (Hirsch and Nation, 1992). Research also indicate that the relationship between L2 learners' syntactic knowledge of English and text comprehension intersect with vocabulary knowledge, background knowledge and L2 proficiency (Garcia, 2003). These assertions validate the use of reading texts to measure vocabulary proficiency in L2 learners.

Laufer and Nation (1995) developed a newer version of the Vocabulary Levels Test proposed by Nation (1983; 1990) with similar target words, but instead of matching words and definitions, the test takers need to write the missing target words in a set of sentences. This blank filling version was used to provide evidence for the lexical frequency profile (LFP) test. This test item requires more word knowledge and more use of contextual information indicating that it might be a more effi-

cient test of vocabulary knowledge. However, these tests are decontextualised and do not account for the sphere and context of reading.

Read (2000: 9) further proposed three dimensions in connection with vocabulary assessment to account for a wide variety of testing procedures. These are discrete to embedded, selective to comprehensive, and context-independent to context-dependent. The communicative approach to language teaching has gained prominence in the last three decades and poses questions to the validity of the traditional decontextualised vocabulary test and is stimulating a reconsideration of the type of lexical ability, and how it is possible to best assess it. (Read, 2007). In their analysis of current vocabulary assessments, Pearson, Hiebert and Kamil, (2007) found that many vocabulary assessments tested words in a decontextualised manner and recommended contextualised vocabulary assessments as a priority to predict both passage specific and general comprehension. The current vocabulary proficiency tests are based on reading texts.

3.8 Readability of the Selected Texts

Read (1988: 15) states that designing of vocabulary tests need to account for specific groups of learners, especially if they test academic learners at tertiary levels of learning. Read (1988) advises designers to introduce particular sets of words referred to as "sub technical vocabulary" that appear habitually in academic readings and discussions. The current tests measure participants' technical vocabulary knowledge in context alongside lexical knowledge and depth of vocabulary knowledge.

The relationship between vocabulary and reading has been well established. Reader's comprehension of vocabulary predicts the reader's comprehension of text. The reading texts discuss themes of renewable energy and sustainable development. Sustainable development is a topic that underpins studies in engineering at tertiary levels. It is anticipated that students read and research texts with an emphasis on

the aforementioned topics. Hence, the choice of reading texts that deals with the topic in the tests.

The reading texts selected were analysed for readability using the Flesch Reading Ease test. The diagnostic tool assisted in finding keywords, density and prominence of words or expressions in the text analysed. Receptive vocabulary skills and lexical knowledge are measured through the selection of the most frequent words in the reading texts. Depth of vocabulary knowledge is measured through the least frequent content words in the text, and productive vocabulary skills are measured through tasks that test participant's knowledge of technical words and phrases in the texts. Readability and lexical density of the reading texts were analysed using the Flesch Ease score. Items selected as test items are all content words or phrases.

3.8.1 Reading Level Algorithms

Readability is the measure of how easy it is to read and understand a document. They are mathematical formulas designed to indicate the suitability of texts. Computerising the process has made it easier to determine text suitability for its intended audience. The mathematical formulas correlate to measurable elements of writing and are based around the average number of syllables in words or number of words in sentences (Stephens, 2000). Flesch Reading Ease test was used in the analysis of the texts. Although, readability tests only provide an indication of the reading ease for a document, Flesch-Kincaid and Flesch Reading Ease tests are the most commonly used reading level algorithms today (Readability Tools, 2007). The Flesch Reading Ease Score identifies readability based on the average number of syllables per word (ASL) and the average number of words per sentence (AWS). However, the readability scale is to be understood as an interpretive score and is not to be taken in an absolutist way. The formula used is given below:

$$206.835 - 1.015\left(\frac{\text{Total Words}}{\text{Total Sentences}}\right) - 84.6\left(\frac{\text{Total Syllables}}{\text{Total Words}}\right)$$

In general, Flesch and Flesch- Kincaid use the following guidelines:

1. The more syllables in a word, the harder it is to read and understand that word.
2. The more words in a sentence, the harder it is to read and understand.
3. The more words about people there are in a passage, the more "interesting" it is to read.
4. The more sentences "addressed to an audience", the more interesting that passage is to read.

The texts have a Flesch Reading Ease ranging from 32- 52.4 and a lexical density of 67.5% to 78.7%. The reading ease scales would indicate that that they range from difficult to fairly difficult. As the intended audience are tertiary engineering students, they are expected to read journal articles and texts that have readability scores graded in the above range.

Table 3.2 shows the values and readability applied in the Flesch Reading Ease Scale

Table 3.2 Flesch Reading Ease Scale

Value	Readability
90-100	Very Easy
80-90	Easy
70-80	Fairly Easy
60-70	Normal
50-60	Fairly difficult
30-50	Difficult
0-30	Very difficult

Source: (Readability Tools, 2007)

In essence, all assessments of reading include vocabulary testing, whether it is of words or terms in context. Tests following reading comprehension can therefore be integrative, via cloze items and reading comprehension items where vocabulary knowledge is expected to make an important contribution. The tasks that follow the texts attempt to assess a range of vocabulary knowledge both receptive and productive.

3.9 Validity and other issues

Ebel (1983: 8 as cited in Messick 1989: 41) sums up centrality of content as:

> "[T]he evidence for intrinsic validity (content validity) will consist of explicit rationale for the test: a written document that a) defines the ability to be measured, b) describes the tasks to be included in the test, and c) explains the reasons for using such tasks to measure the ability. The explicit rationale indicates what the user intends to measure, the test is a valid test for the user's purposes".

The tests provide an evaluative measurement of participants' knowledge of vocabulary in technical vocabulary at academic tertiary level, in particular, first year of undergraduate study in engineering. Brown and Hudson (2002) state that both content validity and construct validity are important for ensuring the validity of criterion-referenced type tests. To ascertain content validity of a test, the degree to which items on a test and resulting scores are representative of the sample of content or ability the test is measuring, must be considered (Brown & Hudson, 2002). Scoring criteria for the test have been carefully considered. On the other hand, construct validity also relies on experimental studies of the degree to which a test is measuring the psychological constructs it claims to be measuring (Brown & Hudson, 2002). The reading tests were designed for first year undergraduate engineering students, whose native language is other than English and are L2 learners of English. Learners' vocabulary size has been found to correlate directly with reading comprehension (Beglar 2000;

Laufer, 1992; Qian, 1999) and with writing ability (Astica, 1993; Beglar, 2000; Laufer 1998; Laufer & Nation 1995).

3.10 Test Specifications for Test Validation

For validation purposes, test specifications require a theoretical framework that forms the basis of the test characteristics and explains the relationships among its constructs as well as the theory and purpose for which the test is designed (Alderson, Clapham & Wall, 1995). Theories for test construction may be implicit and encapsulate beliefs about language or it may be based on an explicit model. The most significant aspects to consider for test construction are well-articulated constructs and the ability of the test to measure the constructs. The Bachman model is one of the theoretical framework developed for language test analysis by the University of Cambridge Local Examination Syndicate (UCLES) and Educational Testing Service (ETS) (as cited by Alderson, Clapham & Wall, 1995) which was used as part of the current test construction and validation process.

The Bachman model considers communicative language ability and test method factors and its components comprise grammatical competence, (inclusive of vocabulary, morphology, syntax and phonology) and textual competence among aspects. The model also takes into account pragmatic competence and test method facets and the relationship between input and response. Needs analyses have been carefully considered for the construction of the current CRT- type diagnostic (vocabulary proficiency) tests and similar CRT-type achievement (vocabulary proficiency) tests.

3.11 Construct Validity and Face Validity

Hughes (1999) claimed that a test that establishes that it measures the ability or component it says it measures has construct validity. Hughes (1999) further states that the word "construct" refers to any principal ability or attribute which is hypothesised in a theory of language ability, for instance, a hypothesis that states that the

ability to read involves a number of sub-abilities, such as the ability to guess the meaning of unknown words from the context in which they are met. Hughes (1999) argued that construct validation is a research activity, through which theories are tested, and are verified, adapted or not considered at all, and that a test must measure what it is expected to measure for it to have face validity. Tests that do not appear to be valid to test takers may not be taken seriously for their given purpose (Alderson, Clapham & Wall, 1995).

3.12 Reliability Coefficient

The reliability of a test is dependent on the way it is constructed, administered and scored. The way in which a test quantifies reliability is said to be its reliability coefficient (Hughes, 1999; Read, 1998; Chapelle, 1999). The most common method of obtaining reliability coefficients and two sets of scores involve only one administration of one test and is termed "internal *consistency*", and one of the basic ways is the "*split half method*", in which the test taker takes the test in the usual way but each test taker is given two scores, one for half of the test, and the second score for the other half (Hughes, 1999).

The current CRT-diagnostic and achievements tests use the split half method to determine reliability coefficients as there are four sets of tests in the CRT diagnostic vocabulary proficiency tests and four CRT-achievement vocabulary proficiency tests. The tests are split into equivalent halves, through the careful matching of items. This is achievable given the identical nature of the test items and level of difficulty of each item and test, which is similar. Empirical demonstrations have acknowledged that this economical method will indeed give good estimates of alternate forms coefficients if the two halves tested are similar (Hughes, 1999). *Standard errors of measurement* of the tests quantify the probability of the test takers' scores.

3.13 Summary of Chapter

This chapter has reviewed and discussed research paradigms relevant to the study. It has provided rationalisations for the methodological research framework selected as well as the research paradigms and perspectives critical to the study. The rationale for the use of case studies is given. The chapter has addressed the issues of validity and reliability in case studies as they apply to this study. The chapter has further reviewed the relevant assessment tests developed for receptive and productive vocabulary development and demonstrated that assessing vocabulary knowledge is manifold and that one needs to select plausible materials and adequate procedures to gain valid and reliable results. A range of tasks/tests are required to address diverse aspects of the lexicon. The chapter has shown how critical it is to develop context specific vocabulary tests that are valid and appropriate for L2 learners for English. Recent vocabulary research places emphasis on definitional and contextual knowledge as critical. An emphasis on definitional and contextual knowledge testing is necessary to measure the vocabulary proficiency of the L2 learner in totality. The current test attempts to test learners on definitional as well as contextual knowledge of words.

The next chapter will look at the research methods employed in the study to answer the research questions that guide the study, and to achieve the study's objectives.

Chapter 4- Research Design, Methods, and Rationale

This chapter focuses primarily on the research design and research procedures employed in the study and sets out the research questions and objectives. Further, it positions the research objectives within the research methods employed. The chapter then presents the underlying principles for data selection procedures and for the criteria applied in the study. The details of the English language experiences with which participants entered the study and the selection of participants are presented next, followed by the discussion of sampling methods and the data collection methods. The research procedures carried out both in Phase One and Phase Two of the study are explained next and discussions are provided on the conditions for conducting the CRT-diagnostic and CRT-achievement tests which measured vocabulary proficiency in context. The instructional approaches employed in the experimental groups are then summarised followed by the presentation of the data analysis procedures and the confidentiality issues involved in completing the present research study. The research identified two threads or aspects of vocabulary development and holistic analysis was used to answer the underlying research question of how adult L2 tertiary learners developed vocabulary. The chapter concludes by discussing the limitations and significance of the study.

4.1 Research Objectives and Research Questions

There are three research objectives for the present study which are (1) to investigate patterns of inferencing strategies; (2) to investigate the role of context on

inferencing strategies and (3) to analyse the role of teaching explicit inferencing strategies in the vocabulary development of L2 learners.

Objective 1

a) To investigate patterns of inferencing strategies occurring between pre-receptive stages of vocabulary and productive-vocabulary stages in L2 vocabulary acquisition. This objective will be addressed via the following research questions.

Research Questions

1. Does pre-receptive vocabulary proficiency influence the inferencing strategies of L2 learners?

2. Do L2 learners infer word meanings and formulate positive transfer strategies during academic reading activities?

3. What types of strategies do L2 learners employ for text processing that assist in developing vocabulary?

Objective 2

a) To investigate the role of constructivist learning principles on context; and
b) To investigate the language inferencing strategies in the vocabulary development of L2 learners; and
c) To develop a theoretical model of L2 vocabulary development.

These objectives will be addressed via the following research questions.

Research Questions

1. Does explicit reading instruction assist L2 learners in developing vocabulary from context?
2. Do constructivist learning principles, including peer interaction, influence building of lexical schema?

Objective 3

a) In light of the above findings, evaluate the L2 theoretical model developed to account for the interaction of the inferencing strategies, role of context and explicit instructional mediation from current vocabulary proficiency to productive vocabulary acquisition in L2 learners.

Research question

1. Do inferencing strategies in L2 learners change as a result of instructional mediation?

4.2 Research Design of the Study

As outlined in Chapter 3, this study employed a mixed-method research design to provide a depth of information through "particularity, closeness and contextualised understandings of local meanings" and also width of knowledge through "generality, distance and analysis of regularities" (Caracelli & Greene, 1997: 27). The study categorises the inferencing strategies of L2 learners, drawing significance to the

role of context, while explaining the influence of explicit teaching of strategies in the acquiring of vocabulary in adult L2 tertiary learners.

In the first phase the researcher gathered information about the phenomenon occurring in a bounded unit with the purpose of analysing, interpreting or theorising through verbal protocol analysis (VPA). VPA is believed to be a qualitative introspective technique used increasingly in second language acquisition (SLA) through which individuals' verbalisations can be seen as accurate records of information about a particular task and involves participants 'thinking aloud' while the task is carried out (Green, 1998). The participants are also asked to verbalise retrospectively after the task is carried out for additional information on inferencing strategies applied during reading tasks. In this study both concurrent and retrospective verbal protocols were utilised to study the inferencing patterns of adult L2 learners occurring during reading. The level of abstraction and conceptualisation in interpretive case studies ranges from suggesting relationships among variables to constructing theories (Merriam, 1998). The study brings to light developmental patterns in L2 vocabulary learning and acquisition occurring in adult tertiary learners using multiple sources of data gathered.

Chapter 3 has explained why a constructivist perspective is employed in the current study. The qualitative approach is inductive, leading to interpretive or analytical constructs, even to a theory. The study begins from a knowledge claim position of constructivism in which 'multiple participant meanings' (Lincoln & Guba, 2000) are assumed. The study is situated in a social constructivist learning environment where peer learning is encouraged. Applying a constructivist framework to language learning brings focus to the active engagement and intellectual exchange between the L2 learner and the instructor. Apart from analysing the learners and the setting, qualitative research applied in the study encourages an insider's perspective on the best ways to deliver or design the instruction. The research design has taken into account the strategies for conducting the research study, the conceptual framework for the study, the participants, and the instruments or data gathering tools for collecting and analysing the research data

gathered. The research questions stated in the earlier section of the chapter show how they are connected with the data gathered. Aligned to qualitative research enquiries, the case study method is used to understand the phenomenon investigated in depth, recognising the complexities associated with the topic and the context in which it is situated.

A schematic representation of the study is given below:

Pilot Study

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┌──────────────────────────────────────────────────────────────────────┐
│   Study involving verbal protocol to identify the inferencing strategies of L2 learners   │
└──────────────────────────────────────────────────────────────────────┘

                    Phase One                    │
                                                  ▼
                    ┌──────────────────────────────────────────┐
                    │   Analysis and classification of strategies   │
                    └──────────────────────────────────────────┘
                                       │
                                       ▼
                    ┌──────────────────────────────────────────┐
                    │   Development of L2 vocabulary model       │
                    └──────────────────────────────────────────┘
                    Phase Two                      │
                                                   ▼
```

Pre-test in both groups for prior vocabulary knowledge in L2 learners

Control Groups | One semester | Experimental groups

Normal unmediated syllabus;
Standard academic reading activities

Teaching strategies that
have been identified;
Academic reading activities with explicit strategies

Vocabulary test measurement of meaning for both sets of groups

Statistical analysis of differences (using *t*-Test)

Establishment of L2 vocabulary model

Fig. 4.1- Research Design of Study

The present study introduces the concept of *pre-receptive vocabulary* as an attribute of the proficiency of the L2 learner before encountering unknown words. The study believes that the pre-receptive vocabulary proficiency is a state which is prior to the stage where L2 learner receives new words for the first time. In this state the L2 learner has an established L1 schema quite unlike the individual's L2 schema and how the L2 is developed may have bearing on the foundations of language learning established earlier through the acquisition of the learner's L1. It is distinct from the belief of word familiarity which has been used to discuss the degrees of knowledge between receptive and productive vocabulary. The present study believes that pre-receptive vocabulary knowledge is an essential aspect of the L2 learner that cannot be disregarded in L2 vocabulary learning.

4.3 Data methods and Selection Criteria

The use of mixed methods is considered most valid for this study as using more than one method allows the researcher to capitalise on the strengths of each method. The use of verbal protocol analysis (VPA) or think aloud procedures were used in phase one of the study to elicit inferencing strategies used by L2 learners in acquiring vocabulary. VPA has been used with success in language research studies, to investigate test comprehension (Laszlo, Meutsch & Viehoff, 1988), and in incidental vocabulary acquisition studies (Paribakth & Wesche, 1999). VPA has been extensively used to examine changes in knowledge and process as skill develops, and findings from research studies that examine changes in knowledge and processes in skill development have important implications for both the understanding of construct validation and for approaches to validation (Green, 1998). The central notion of protocol analysis is that it enables the researcher to instruct subjects to verbalise their thoughts in a way that does not modify the order of thoughts mediating the completion of a task and therefore is acceptable as valid data on thinking (Ericsson, 2002).

The verbalisations gathered in phase one of the study were recorded by the researcher and were consequently transcribed, scored and evaluated for levels of understanding. These verbalisations offered the researcher insights into the cognitive processes of the L2 learners. Verbal reports include three categories of data: a) self report, where learners provide descriptions of what they do, this is generally characterised by general statements about learning behaviours; b) self-observation, which is the inspection of specific rather than generalised language behaviour soon after a learning event, and c) self- revelation, which is a "stream of consciousness disclosure" of thought processes while the information is being attended to (Cohen, 1996: 13). Verbal reporting methods that have been ascribed in educational research were used in the study because they provide data on cognitive processes. The verbal reports gathered both concurrently and retrospectively are believed to provide a cogent understanding of the vocabulary learning processes occurring during text comprehension.

Developing coding categories for the data gathered have strengthened the interpretation of statements made by individual participants in that each code categorised segments of the text that referred to an inferencing strategy or vocabulary learning skill. Content analysis and analytic induction were used implicitly in the analysis of qualitative data in the present study and although content was analysed qualitatively for themes and consistent patterns of meaning, a quantitative approach has been taken to content analysis through the development of theoretical units of analysis. The process necessitates the simultaneous coding of raw data and the construction of categories that capture relevant characteristics of the content. Examples of coding can be found in Appendix H. Categories and subcategories were mostly constructed through comparative methods of data analysis. Units of data that are common must be grouped; it can be something small as a word that a participant has used to describe a phenomenon (Merriam, 1998). According to Lincoln and Guba, (1995), a unit must be firstly heuristic in that it reveals information relevant to the study and stimulates the reader to think beyond the information; and also the unit should be able to stand by itself in the context in which the inquiry was carried out. Detailed theoretical units of analysis were developed from the

data following appropriate coding and segmenting of the data gathered. Category construction begins with the first set of data and moves on to the next set while examining common themes or strands. This data is then compared with the next set of data. The patterns and regularities of the study become the categories or themes into which items are stored (Merriam, 1998).

Lincoln and Guba, (1995) suggest moving from concrete descriptions of data to an abstract level using concepts to describe the phenomena investigated. *Theorising* or thinking about the data helps to develop a theory that explains some aspect of the educational practice and allows the researcher to draw inferences about future activity (Merriam, 1998). Glaser and Strauss (1967) and Strauss and Corbin (1998) refer to what they call the "theoretical sensitivity" of the researcher as a useful concept with which to evaluate a researcher's skill and readiness to attempt a qualitative inquiry.

> "Theoretical sensitivity refers to a personal quality of the researcher. It indicates an awareness of the subtleties of meaning of data. ...[It] refers to the attribute of having insight, the ability to give meaning to data, the capacity to understand, and capability to separate the pertinent from that which isn't (Strauss and Corbin, 1998, p. 42).

The theory provides an explanation for the behaviour and attitudes and it may be complete with variables, constructs and hypotheses (Creswell, 2003). Investigators hope to discover a theory that is grounded in information from participants (Strauss & Corbin, 1998). The study attempted to identify the emergent theories regarding inferencing strategies utilised by adult L2 tertiary learners of English through the development of a conceptual theoretical model of L2 vocabulary learning. Stage two of phase one of the study focuses on the analysis of the data gathered through the verbal protocol in order to develop the conceptual model of L2 vocabulary development in tertiary adult learners.

Second language learner strategies include both L2 learning and L2 use strategies such as retrieval, rehearsal, cover and communication strategies; the explicit goal of language learning strategies is to improve knowledge in the target language (Cohen, 1996). Some cover strategies may reflect the learner's efforts at simplification whereas in communication strategies, a learner may use a vocabulary item that he/she came across for the first time to communicate a thought, or the learner may insert the new vocabulary item into their communication to promote learning of it (Cohen, 1996). A discussion of learning strategies and analysis of the range inferencing strategies employed by study participants is presented in chapter 5 of this thesis which explains the findings from the first phase of the study related to research objective one of the study.

4.3.1 Educational Background of Participants

The 130 students who participated in the study (inclusive of phase one and phase two) came from a first year Engineering undergraduate course. The researcher interacted with the participants specifically in an Engineering communications unit which was compulsory in the course. The researcher had taught communication in engineering for five years prior to conducting the study and was actively engaged in teaching the Communications in Engineering unit during the research study period. The students in the course of study had had an essentially Malaysian background with either Mandarin (Chinese language) or *Bahasa Malaysia* (Malay language) as their first language (L1). Approximately 75% of the students at the current tertiary institution had come through the Malaysian school education system where they had learned English as a second language from standard one to standard six (primary school) up to ages 12, and from form 1 until form 5 (secondary school) until ages 17. English is a compulsory subject in Malaysian schools and is taught for eleven years in mainstream national schools where students are taught up to 3.5 hours of English a week (Murugesan, 2003).

The hours of English teaching received by students varied; where in national schools more time was allocated in the school curriculum to teaching English as opposed to Chinese medium schools where the teaching of English is restricted to fewer hours per week. However, all the participants in this study had completed at least five years of secondary school education in a Science focussed stream where English was taught as a second language and had been assessed for English language proficiency in a national type exit examinations in Form 5 known as SPM (Malaysian School Leaving Certificate Exam). The results of students' secondary school exit examination in Form 5 (equivalent to year 11 in Australian schools) determined entry into a foundation year of engineering for pre-university studies, a course extending to a year. A foundation studies course had to be completed to enter undergraduate programmes at university. Alternatively, students can opt to do a similar matriculation course or complete two additional years at school in Form 6 and appear for the STPM (Form 6 school leaving exam) which is equivalent to year 12 in Australia. Many students prefer to leave school at Form 5 and seek entry to private higher institutions of learning as the study period was shorter (one year as compared to two years in form 6) and places at public universities and matriculation courses were limited.

For students who complete Form 5 and choose to pursue undergraduate study, it is mandatory to complete a pre-tertiary year successfully to qualify for entry into undergraduate courses at Curtin University of Technology. During the Foundation in Engineering course (which spans two semesters of fourteen weeks each), students are exposed to core units that develop content knowledge in Engineering and Science. It is to be noted that all units in the Foundation Programmes and at Curtin University of Technology are taught in English. In addition, students are taught academic writing units that are designed to introduce and develop English language capabilities essential for tertiary education. The purpose of the academic English units is to enhance learner proficiency in the English language and introduce to L2 learners a variety of academic texts.

The outcome-based approach applied in the Foundation in Engineering course helps students to perform a range of academic writing activities such as paraphrasing, referencing and composing research essays that expose L2 learners to the formats and norms of academic writing. Vocabulary building activities are well embedded in the academic English units along with general language proficiency development during the course. There is also a strong focus on developing communication skills in students in the English language through presentations and group discussions in classes in the Foundation in Engineering course. Students are introduced to the concept of cooperative learning and independent learning through the learning tasks and assignments planned for the units. Through the Foundation in Engineering course, students are well prepared to enter the undergraduate programme in Engineering at Curtin University of Technology.

4.3.2 Sampling Methods and Procedures- Phase One

Corresponding to the nature of the study and its main objectives, purposive sampling was used in phase one of the study. In purposive sampling, researchers select participants whom they judge to have knowledge, perspectives and experiences associated to the topic of research and to ensure that the "best" participants are included (Gay & Airasian, 2000: p.140). Further, the authors (Gay & Airasian, 2000) state that in purposeful sampling, the researcher decides on a sample believed to be illustrative of a given population. Qualitative research provides insights into the emic or insider; the knowledge needed by members of a group to participate in socially and academically appropriate ways (Chappell, 1999). Qualitative researchers also select purposive samples believed to be sufficient to provide the greatest understanding of what they are studying and use their knowledge and experience to select sample participants that they believe can provide the relevant knowledge and information about the topic being investigated(Ary, Jacobs & Razavieh, 2002). "Sampling is almost never representative or random but

purposive, intended to exploit competing views and fresh perspectives as fully as possible" (Guba & Lincoln, 1985:276).

Purposive sampling ensured that the depth of information sought was available through the selection of participants, the site of the study and through the context in which the data was accessed. The participants selected for the first phase came from the bounded unit that was the focus of the study. They were believed to have critical knowledge of the phenomenon studied, to be able to provide the etic perspective that is essential in good qualitative research, and to enhance the validity of the conclusions drawn. The data gathered from the participants provide the thick descriptions that helped develop the emergent conceptual model of L2 learning.

4.3.3 Participants in phase one

To set the criteria for the sampling, the study selected a group of about 25 students from the first year engineering degree programme with Chinese/ Malay L1 background at Curtin University of Technology, Sarawak Campus. Merraim (1998) argues that with regard to the number of participants required in a qualitative type of study, there are no correct answers. In general, qualitative research uses small and non-random samples and lay emphasis on in-depth description of the participants' perspectives and contexts (Gay & Airasian, 2000). The samples are smaller allowing the researcher to spend more time making an in-depth analysis of the topic he or she is researching. The study employed samples with uniform background for establishing consistency in the data gathered.

Duff (2007) affirms that consistency in sampling and data analysis is the hallmark of rigorous research. The study has ensured consistent sample participants through careful selection. Firstly, the participant group was given a reading task which involved reading a technical text and retrospective verbal protocol reports were collected

immediately after the task had been completed. These retrospective verbal protocol reports were gathered individually. A preliminary explorative analysis was used initially, to obtain a general sense of the data and to determine whether additional data needed to be gathered. Additional concurrent verbal protocol was gathered from a sample population of 16 participants involving reading a technological text. Both individual and group concurrent verbal protocol was gathered during the reading task. A total number of 41 participants provided data on L2 inferencing strategies employed which are inherently complex procedures involved in text comprehension. The participants are sample representative of the population of L2 learners at a tertiary level of education in Sarawak and are representative of the bounded unit or group that is the focus of investigation. Another important criterion of the sample is that the L1 of the sample population is either Chinese or Malay as this group is the focus of the study.

4.3.3.1 Retrospective and Concurrent Verbal Report Analysis Procedures

In the first phase of the study, retrospective self-reports were elicited on an individual basis so that strategies suggested by one participant would not unintentionally stimulate another participant. In this phase, study participants were asked to report retrospectively on their vocabulary learning strategies following the reading of a short technical article. O'Malley & Chamot (1996) refer to the contiguity of data collection with the task about which the respondents are asked about the use of learning strategies and state that it was an essential determinant of the category of information that one can anticipate. Verbal reports are considered to provide useful information about learning strategies in language research (Hinkel, 2005). Protocol analysis is an accurate methodology for eliciting verbal reports of thought sequences and is a valid source of data on thinking (Ericsson, 2002).

In the field of language testing, protocols are mostly expected to be gathered from subjects who are representative of the group (Green, 1998). All the participants had

volunteered to participate in the study after the researcher had made an announcement to groups of first year engineering students at the university. Firstly, each participant was given a reading text specifically related to engineering discipline containing technical vocabulary, following which they were requested to verbalise their thoughts in an audio recorder. The participants were given specific explanations on what constituted verbal protocol. Each participant provided the verbal protocol individually and was given a quiet space to be by himself/ herself while completing this activity. The researcher sat unobtrusively in another section of the room leaving the study participant to concentrate and think aloud on the task just completed. This activity was designed to recognise strategies employed in reading and comprehension of text and to understand transfer processes employed by L2 learners in developing productive vocabulary. The activity attempted to raise awareness in the L2 learner regarding their first language ability in comparison to their L2 language. In addition, it endeavoured to investigate the L2 learners' vocabulary retention processes. The interaction between the researcher and the participants was minimal and no attempt was made by the researcher to influence the performance of the participants other than elicit the verbalisations through written instructions and simple explanations prior to gathering the data. Nunan (1992) recommends discreet practices as characteristics of an ethnographic approach to research in language learning.

The participants were informed of the proposed verbal protocol procedures and provided the choice to participate or not. Respondents who agreed to participate were provided with a letter of consent which they signed adhering to the ethical guidelines of the study. The participants were provided with a few questions on an information sheet to guide their thoughts for the verbal protocol which are shown in Table 4.1. "Verbal probes" are the latest additions to pure think alouds (Willis, DeMaio & Harris-Kojetin, 1999). Probe questions can be written prior to the elicitation session or can be chosen from a stock set when the elicitor judges them as appropriate, or can be created by the elicitor and are advocated by Conrad, Blair & Tracy (2000), to clarify behaviours that signal reservations or doubts. In the present study, written probe questions to guide the retrospective self-reports were provided to the participants to prompt valuable

information considered crucial to ascertain the research objectives stated earlier and also to check for matches in thematic descriptions obtained subsequently from concurrent verbal protocol during the process of reading. The participants were informed of the importance of their contributions and that the disclosure of their mental processes would be informative to the research objectives, and were encouraged to verbalise their thoughts as completely as possible.

Retrospective verbal reports and concurrent verbal reports are premised within the methodology of verbal protocol analysis. Probe questions elicited a range of relevant responses regarding vocabulary learning and inferencing patterns as seen in the transcribed responses from the participants, and also assisted to prompt the less verbal participants for more information.

The validity of the verbal reports depend on how closely the method of eliciting them had adhered to the principles of the procedure and therefore it is important that appropriate instructions are used to direct the construction of verbal reports (Green, 1998). The use of guide questions as probes is considered to be un-interruptive and constructive to the data generation process. The reliability of verbal reports is dependent upon the extent to which the coding scheme accurately captures behaviour and therefore reliability of the technique is related to the validity of the coding scheme (Green, 1998).

Table 4.1, shows the written probe questions provided to the participants to guide their verbalisation processes.

Table 4.1.Questions provided to guide the respondents

1. When you read articles and come across difficult words, what sort of strategies do you use to understand the meanings?
2. Once you have understood the words, do you use them in your own writing?

3. Can you provide some comparisons regarding your proficiency in English to your own first language?
4. What other strategies do you use to retain new words or use them as part of your vocabulary?
5. When do you consider the new words encountered as part of your mental lexicon?

The data gathered were identified for patterns, consistencies, repetitions and expressions significant to the subject of the investigation. Subsequent to the verbal protocols being collected on the audio tapes, they were first transcribed and then examined to draw out codes according to a pattern or representation. The transcripts were coded independently by the investigator and inter-rater reliability was established with an experienced colleague who was a native English speaker. All protocols were coded independently by the researcher and the colleague and meetings were held to review the coded protocols for reliability checks and for discussing difficulties in coding. The verbal protocol data gathered were transcribed according to the orthographic transcription conventions recommended by Lemke (1995) who referred to thematic content as that which represents processes, activities, and relationships and the participants in these processes, and circumstances of time, place, manner, means etc. Orthographic transcription is a verbatim record of what is said by participants which includes repetitions, pauses etc.

Appropriate symbols were developed for the transcripts through discussions with two additional raters to reflect pauses and thinking intervals. The transcripts were analysed to answer specific research questions. Green (1998) recommends the segmenting of the verbal protocols as representative of a single specific process. Green (1998) further suggests that a balance must be maintained between the researcher's desire

for coding that reflects every nuance of the verbal report and the need to establish inter-rater reliability. Inter-coder reliability was established with an experienced colleague who was also a native speaker and an agreement of 98% was achieved to the allocated symbols in the transcribing process as shown in table 4.2. Minor discrepancies occurred due to difficulties in recognising accents employed by the L2 learners and were resolved through discussions.

Table 4.2 Symbols Used for Transcribing

/=short pause
//=longer pause
[*]= filled pause

The inferencing strategies employed in L2 vocabulary learning and development were identified. Many researchers acknowledge that transcription is an innately theoretical process dependent on the theories that the researcher upholds and influences the analysis and interpretation cycle (Chafe, 1993; Edwards, 1993; and Poland, 1995).For concurrent data analysis gathering, sixteen additional participants contributed to individual and group concurrent verbal protocol analysis. They were given a technical reading text entitled "New Mexico unveils spaceport design" (2007). (See Appendix E). The reading text was selected for its use of appropriate technical vocabulary and its lexical density. In concurrent verbal protocol, the meta-cognitive processes are gathered as the task is carried out and while they occur. Each participant was requested to verbalise their meta-cognitive processes (in an audio recorder) while they read, in an effort to record strategies employed in reading comprehension and for identifying text meaning as it occurred. The procedures followed for concurrent data gathering were similar to the retrospective self-reports and data gathering processes and adhered to the ethical guidelines outlined for the study. Research in the area of reading also focuses on the role of meta-cognition. Anderson (2002 p.1) defines meta-cognition as "thinking about thinking." The participants were provided with explanation on verbal protocol

analysis to obtain a true record of the phenomenon studied. Verbal protocol analysis required subjects to give a verbal protocol (or "think" aloud) while performing the reading task. Both individual and group verbal protocols were gathered through audio recorders. The verbal protocol gathered was then transcribed and coded. Inferencing patterns and text meaning construction methods were identified for analysis. The collection of multiple verbal protocols from a total of 41 participants, both concurrent and retrospective, provided the requisite information required for a complete analysis of inferencing strategies employed by adult L2 learners in text construction, comprehension, vocabulary learning and development. Data gathering was considered complete when the categories identified were defined, the constructs created were comprehensive, and repetitive patterns emerged from the data as a whole.

4.4-Phase Two of the Study

Phase two of the study examines the teaching of explicit knowledge of strategies identified from phase one of the study, which investigated the inferencing strategies participants used to comprehend meanings of low-frequency words encountered in reading, and how participants developed productive vocabulary. The first stage of phase two involved case studies of uniform groups of students from a university first year engineering program, who were grouped into two control groups, and two experimental groups. Through the identification of inferencing strategies and theoretical units of analysis from phase one, a conceptual model of L2 vocabulary acquisition was developed. In phase two, the validity of the conceptual model is evaluated. Four groups of students from the first year engineering degree program form the bounded unit of focus in phase two of the study. Two experimental groups were identified in which an intervention or treatment utilising explicit teaching of inferencing strategies in reading was employed which was not applied in the two control groups. The control groups were

provided with standard teaching procedures. The experimental groups were taught by the researcher while the control groups were taught by an experienced colleague.

The use of control and treatment group evaluation is essential to determine the effectiveness of the explicit teaching of strategies. Ideally the two comparison groups should be equal in all respects except for the independent variable which is controlled by amount, type, absence or presence (Gay, 1996; Johnson & Christenson, 2004). Variables such as learner background were determined to be uniform in the four groups. Uniformity of L2 vocabulary proficiency was tested and confirmed from multiple groups via specially designed contextual criterion referenced tests (CRT) diagnostic vocabulary proficiency measuring instruments. Comparing the pre-test scores of the two groups (control and experimental) is the only way in which one can ensure to exclude initial selection difference as a threat to internal validity (Wiseman, 1999). Following the initial selection of the four groups based on the uniformity of scores attained in the CRT-diagnostic vocabulary tests, the four groups were randomly assigned to be experimental and control groups. As the intervention or treatment was to be carried out by the researcher, the researcher taught the experimental groups. Random assignment of groups and homogenous nature of the groups in terms of L2 vocabulary proficiency have strengthened the internal validity of the educational experimental design adopted in the study.

The analysis of results and the implications of findings from the research experiments applied in the study will be discussed in chapter 6.

4.4.1 Research Procedures in Phase Two

Prior to the commencement of the teaching semester, the subjects were already randomly assigned in groups by the school/ faculty area. Specially designed criterion referenced tests (CRT-diagnostic) to test vocabulary proficiency in context,

were administered in six groups of participants at the beginning of the fourteen week semester comprising of twelve teaching weeks and two teaching free weeks, to measure the vocabulary proficiency level in English of the L2 learners. The four uniform groups in which homogeneity in terms of vocabulary knowledge and language proficiency was established were then selected for inclusion in the study. The researcher taught the two experimental groups in which an intervention was utilised and the two control groups were taught by a colleague who followed standard teaching procedures outlined for the unit by the faculty.

Each group of learners comprised between 20-23 participants. In the experimental groups academic reading activities were carried out with explicit instructional mediation to match the strategies identified in the first phase of the study, combined with other recommended vocabulary learning strategies. A normal syllabus with standard academic reading activities was taught to the two control groups for the same duration by a colleague. Criterion referenced tests (CRT-achievement) vocabulary tests were administered to the two control groups and two experimental groups at the end of the semester in order to measure productive vocabulary development and to ascertain whether L2 learners benefit from explicit instruction. The influence of explicit teaching instruction and levels of vocabulary development is measured through the use of specifically developed CRT (achievement) tests or L2 vocabulary measurement instruments. The CRT diagnostic tests and CRT achievements tests given in Appendix A-D of the thesis are identical. Keeping the pre-tests and post tests identical enabled the researcher to study comparisons of differences between pre-treatment and post-treatment behavior in the experimental and control groups, and also attribute any gains in the post-test results in experimental groups to the influence of teaching explicit vocabulary strategies.

 Validity and reliability of the tests had been determined as outlined in sections of chapter 3 on the design of the vocabulary proficiency tests. The test construction procedures are explained in sections 4.6 and 4.7 of this chapter

A parametric test such as the *t*-test for independent means is used to evaluate the difference in means between the two groups of participants in the study. The *t*-test is appropriate to determine whether a difference between the means of two samples is significant (Fraenkel & Wallen, 2000). In the present study the *t*-test for independent means is used to compare the mean scores of the two different types of independent groups which are the control and experimental groups. Further in phase two, the refining of the vocabulary model that accounts for the interaction of the inferencing strategies, the role of context on the inferencing strategies and the influence of explicit mediational instruction on vocabulary development in L2 learners from their current vocabulary proficiency to productive vocabulary acquisition were conducted.

The current CRT-diagnostic and achievements tests used the split half method to determine reliability coefficients as there are four tests in the CRT diagnostic vocabulary proficiency tests and four CRT-achievement vocabulary proficiency tests. The tests were split into equivalent halves, through the careful matching of items. This was achievable due to the identical nature of the test items and the similarity in the level of difficulty of each item and test. *Standard errors of measurement* of the tests quantified the test takers' scores. From the CRT-diagnostic vocabulary tests in four uniform groups the value of the split-half coefficient ranged from .80-1.0, indicating excellent reliability.

4.5 Instructional Approaches

The typical instruction in the unit centred on building communicative competence both oral and written in engineering contexts, focussing on generating engineering reports, site visit reports and projects carried out for the unit. In the control groups, the instructional activities provided students with a large exposure to engineering vocabulary and the opportunity to use them in writing. While similar instructional activities occurred in the experimental groups, there was an increased attention to teaching and developing vocabulary incorporating the sixteen inferencing strategies

identified earlier in the study. The difference in approaches in the control and experimental groups can be seen in the sample weekly seminar schedule for the whole semester shown in table 4.3

In the experimental groups, the awareness of using inferencing strategies were emphasised as informing students about the purpose and importance of the strategies in vocabulary learning was believed to be important in order for students to develop independent vocabulary learning strategies.

Following the selection of experimental groups, the researcher commenced the teaching of explicit vocabulary learning strategies in the groups. The researcher firstly introduced the importance of developing engineering/technical vocabulary as academic writing activities in the course stipulated students to build a repository of technical and specific vocabulary to be demonstrated throughout the course, and for professional practice. The researcher discussed different methods and strategies that could be used to develop productive vocabulary with the experimental groups. These explanations were provided to raise awareness of vocabulary learning strategies, to motivate the students to be more participative in classroom activities and to encourage them to try out the new strategies discussed. Students were also encouraged to analyse for themselves which strategies worked best for them, such as memory, cognitive, meta-cognitive and social inferencing strategies. The intervention or explicit instruction of vocabulary strategies was the independent variable in the study.

Each strategy was modelled by the researcher for the study participants in the experimental groups as shown in the weekly schedule in Table 4.2, through various reading and writing tasks aligned to unit needs that involved using engineering related texts for references in writing engineering reports, site visit reports and for oral communication needs. Efforts were taken by the researcher to elucidate the strategies continuously throughout the semester and provide opportunities for practice. Participants in the experimental groups were encouraged to pay close attention to inferencing strategies in peer groups and the researcher often encouraged sharing of inferencing

strategies by peers in the classroom. Class discussions often educed the different ways in which the inferencing strategies were employed by the participants and the researcher often listed the strategies found to be effective by the participants on the whiteboard for visibility and awareness.

4.5.1 Teaching Text-processing vocabulary strategy

In week two of class students in experimental groups C and E were introduced to the concept of text-processing vocabulary strategies and awareness raised on context analysis and morphemic analysis in engineering text discussions. Firstly, students were introduced to some of the readings and in groups asked to identify unfamiliar words. Students were also requested to attempt comprehension of words using context clues. Readings focussed on water treatment topics and students identified words in technical contexts. Students were asked to focus on word parts, prefixes and suffixes and then arrive at an understanding based on analysis of context. Following the activity, participants shared their responses with the class. In particular, the facilitator observed how groups worked and highlighted to groups their own strategies such as how their own understanding and interest in words helped them to arrive at comprehension and successful word meanings.

4.5.2 Teaching Structural Analysis Strategy

In week three, students completed tender evaluations processes in relation to their engineering projects. Students in experimental groups C and E were introduced to terminologies arising from the engineering tender documents. Tenders were awarded based on whether project groups had: a strong understanding of project designs; references to the quality and quantity of materials used; technical professionalism and accuracy of properties; and predictions of project deliverables. This task provided

opportunities for students to work in groups and identify key words from tenders and projects, and attempt comprehension and word meanings accordingly. The instructional mediation for arriving at word meanings focussed on how students could integrate new linguistic information through multiple exposures to words, and by using dictionaries. Students were also encouraged to use the new words they discovered in their own writing in technical engineering reports.

4.5.3 Teaching English for Specific Purposes

In week four students worked on writing project reports. Writing project reports necessitated them to explain project outcomes and processes and needed them to refer to several readings and journal articles. This provided opportunities for the instructor to bring words used in specific contexts or disciplines to the attention of students in the experimental groups. Students were asked to work on their draft project reports. They needed to compose sections pertaining to the background of the problems they had identified during their industrial site visits. During the drafting process students familiarised themselves with the strategies of retaining new words based on their search results from journal references and, the need to use words in these contexts and evaluations of use words.

4.5.4 Teaching Strategies for Guessing Meaning of Unknown Words

In week five students were introduced to the strategies of guessing meanings of unknown words. For this task, they were given technical readings and asked to identify words previously not known to them. Then in groups they were asked to guess the meanings of words using context clues and morphological clues. Attempts were made to get groups to speak about how they arrived at meaning of words and strategies they had used. Groups who were unsuccessful at guessing accurate meanings of the words they had identified were asked to give reasons for their lack of understanding. Groups who were successful in identifying the meanings of unknown words were asked to share the methods they used

in successful guessing. These activities helped highlight to the students procedures that could be used for guessing meanings of unknown words.

4.5.5 Teaching Transfer Process Strategies

In week six and seven students focussed on drafting site visit reports. For this assignment, they had to prepare reports for the site visits before and after the actual visit itself. Once students were informed of the sites they would be visiting (a minimum of two sites are visited for the unit), they needed to understand the type of facility they would visit and anticipate the type of engineering processes they could study. Further they needed to prepare a list of questions they could pose to senior site engineers regarding engineering processes at the site. The pre-site visit task enabled them to research on the site and its functions. During the visit, they were asked to identify problems in specific areas. Following their visits they had to construct engineering site visit reports that reflected usage of academic writing in specific disciplines. They had to use terminologies relating to specific areas of engineering such as chemical engineering, electrical engineering and power engineering, to name a few. In class, students were asked to work on their drafts and identify terminologies required, and the lists of words that represented concepts from specific disciplines. Students who reported that using L1 cognates helped them in writing drafts were asked to share their strategies with other groups. Then the instructor discussed ways in which transfer processes could be used to enhance word production.

4.5.6 Opportunities for Oral and Written Word production

In weeks eight, nine and ten, students focussed their efforts on developing their site visit written reports and creating presentation profiles for their team projects. Students were provided constructive feedback on their individual reports, especially on using appropriate academic and technical language within their writing. For example, when students refereed to 'safety gear' in their reports, they were reminded to use phrases such

as 'personal protective equipment'. The provision of written verbal feedback individually by the instructor prompted them to review the engineering terminology usage within their written reports. The feedback and classroom sessions provided opportunities for fervent discussions among themselves and raised awareness in them about using accurate words within their reports and presentations.

Students working in teams had to create handouts for their oral presentation sessions in class. This was another opportunity for the instructor to work with them on the usage of words. While structuring and conducting dry runs of their oral presentations, the instructor provided suggestions for usage of appropriate vocabulary. Students in the experimental groups ensured that they included engineering terminologies and language that was appropriate for an audience familiar with such terminology. As they had to conduct the presentations for their peers as well as technical tutors who would be present for the sessions, practice gained from the dry run presentations were seen to be of importance. The review and practice sessions encouraged students to use a wide range of vocabulary both technical and academic in their writing and speech possibly contributing to their vocabulary production in these areas.

Table 4.3- EFPC100 Skills Development Weekly Schedule

Week	Control Groups(Groups B & F)	Experimental Groups (Groups C & E)
1	*Introduction to unit*, importance of communication skills to engineering practice.	*Introduction to unit,* importance of communication skills to engineering practices
2.	***Professional engineering communication*** (email, letters and verbal).	***Professional engineering communication*** (email, letters, verbal) Teaching of text-processing strategy, context analysis and morphemic analysis strategy in engineering text discussions
3.	***Tender Evaluation and Progress on project*** (design and drawings) and individual roles in the team	***Tender Evaluation and Progress on project*** (design and drawings) and individual roles in the team Teaching of structural analysis strategy, multiple exposure strategy, and dictionary use strategy in engineering text discussions
4.	***Report Writing***: The introduction, contents page, decimal notation and ethical scholarship. ***Resources:*** Appropriate sources for academic research.	***Report Writing***: The introduction, contents page, decimal notation and ethical scholarship. ***Resources:*** Appropriate sources for academic research. Teaching strategy of peer learning, English for specific use and enquiry of limited processing strategy
5	***Report writing:*** executive summary, conclusion and recommendations. Brainstorm site visit issues	***Report writing:*** executive summary, conclusion and recommendations. Brainstorm site visit issues Teaching strategy of retaining new words depending on search, need and evaluation
6	***Draft progress report outlines & Company diaries***. Integrating graphics in reports, and in-text referencing.	***Draft progress report outlines & Company diaries***. Integrating graphics in reports, and in-text referencing. Teaching strategies of guessing meaning of unknown words, expressing lack of understanding and visualising
7	***Site Visit Report workshop:*** in teams work on engineering issues for the report	***Site Visit Report workshop:*** in teams work on engineering issues for the report Teaching transfer process strategies
8	***Feedback Session on Reports***	***Feedback Session on Reports*** Raising awareness of productive vocabulary *(Table continued overleaf)*
9	***Developing Oral Communication - Presentation Skills***: language, purpose, audience and context;	***Developing Oral Communication - Presentation Skills***: language, purpose, audience and context; Opportunities for writing new words learned
10	***Seminar skills development -***non-verbal language; use of visuals, slides, collaborative / teamwork skills.	***Seminar skills development -***non-verbal language; use of visuals, slides, collaborative / teamwork skills. Teaching use of technical vocabulary in presentations *(Table continued overleaf)*
11	***Oral Presentations*** Administering test 1 &2 (achievement)	***Oral Presentations*** Administering test 1 &2 (achievement)
12	***Oral Presentations*** Administering test 3&4 (achievement)	***Oral Presentations*** Administering test 3&4 (achievement)

Sections 4.6 and 4.7 provide explanations on the procedures for the development of the tests and the selection of test items.

4.6 Length of Tests

Paul Nation and Batia Laufer (1995) have both utilised versions of the Vocabulary Levels Tests to estimate vocabulary in the following way; if learner A scores 9 out of 12 (75%) on the 2,000 word level, s/he probably knows approximately 75% (1,500) of the first 2,000 words of English. It is recommended that the length of a test be applicable for the proposed type of reading and time allocated for the task (Weir, Yang &Yan, 2000). The CRT-diagnostic type of pre-tests measure current vocabulary proficiency in participants at the beginning of the course and assisted in determining uniformity of groups for control and experimental groups of study participants. Similar CRT-achievement tests were administered at the end of the course to measure vocabulary gains (if any).

The reading comprehension texts selected for the test encapsulate many aspects such as valid content, lexical knowledge, depth of vocabulary and breadth of vocabulary, lexical density, readability, application and knowledge of relevant engineering concepts in domains that learners in the study are accustomed to. The vocabulary proficiency tests are based on four reading texts which are: (1) "Off the Grid with Solar Power", (2) "Solar Flyer", (3) "Efficiency Boost Makes Solar Cells Cheaper" and (4) "Inventor, Engineering Students Explore New Type of Solar Collectors". The reading comprehension texts introduce the topics of renewable energy and sustainable development, subject themes currently emphasised in engineering studies, and focus on solar energy. The participants from undergraduate first year of engineering studies are introduced to the new concepts via sentences of varying lengths and density. The reading texts, on which the current criterion referenced diagnostic type tests are based, are of lengths comprising 371 words, 361 words, 367words and 485 words respectively.

The frequency of words in "Off the Grid with Solar Power" range from 7- 3 (the word *"power"* is used seven times and many other words such as *"grid", "energy"* and *"utility"* are used three times in the text) with a readability measure of 52.4.(The optimal readability is between 60-70). The text has a degree of lexical density of 71.9%. Similarly, the frequency of words in "Solar Flyer" range from 5-2 (the word *"plane"* is used five times and other words like *"stratosphere", satellite/satellites, "solar"* are used three times). The text has a readability measure of 49 and lexical density of 78.7%.

In "Efficiency Boost Makes Solar Cells Cheaper", the frequency range is 9-3 (the word *"solar"* is used 9 times, *"silicon"* is used 5 times and *"cells"* is used four times and *"install"* is used three times). The text has a readability measure of 35.2 and lexical density of 67.5%. In "Inventor, Engineering Students Explore New Type of Solar Collectors", the frequency range of words is 10-3 (the word *"energy"* is used 10 times, *"solar"* is used 8 times, *"panel"* is used seven times, *"system"* is used six times, and *"typical"* is used 3 times). The text has a readability measure of 32 and lexical density of 70.8%.

Table 4.4 shows a summary of the frequency range, readability and lexical density of the reading comprehension texts chosen as articles selected as pre-tests.

Table 4.4 Frequency range, readability, lexical density and no of words in Pre/Post texts

Article	Frequency Range	Readability	Lexical Density	No of words
Off the Grid with solar power	7-3	52.4	71.9%	371
Solar Flyer	5-2	49	78.7%	361
Efficiency Boost Makes Solar Cells Cheaper	9-3	35.2	67.5%	397
Inventor, Engineering Students Explore New Solar Collectors	10-3	32	70.8%	485

Content words are generally referred to as lexical words. Halliday (1994) defines lexical density as a measure of the density of information in any passage of text, according to how tightly the lexical items (content words) have been packed into the grammatical structure. It can be measured, in English, as the number of lexical words per clause. The influence of new information and lexical density as well as passage length on reading comprehension has been emphasised by vocabulary researchers (Johnston, 1983; Alderson, 2000). Alderson (2000) perceives background and general knowledge, motivation and language proficiency as variables relating directly to the reader, genre text-type and lexical density, and points out that designing language test items is more difficult than developing teaching materials, but in principle he views all reading exercises as potential test items.

4.7 Test Conditions- Duration and Time Availability

The draft version of the tests (CRT-diagnostic tests 1 and 2 and 3 and 4) was trialled with a small group of 12 engineering students who had registered for a summer course prior to the commencement of the regular semester and were available to the researcher. The trial group participants were not part of the cohort of study participants. The time given to the trial group participants to complete the test was one hour for completing two tests each. Participants in the trial group completed the tests in about 50 minutes to an hour. It was anticipated that the study test participants require a minimum time of one hour to complete two CRT-diagnostic tests each. Slight revisions were made to the layout following the trialling for better readability. It was expected that these revisions would enhance clarity of each section for improved performance of the test participants. Weir, Yang & Yan (2000) reports that alterations made to timing, order of sections and layouts improved the efficiency of the AERT prototype version 1, an academic reading test developed for tertiary students in Chinese universities.

The draft versions of the tests were also trialled with native English language speakers (experienced academic staff) on campus and the results compared for timing and

ability. Feedback from the native English test takers on the appropriateness and suitability of test items were taken into consideration and incorporated into the review of the final draft version of the tests which have enhanced the quality and clarity of the final version of the tests. Alderson, Clapham and Wall (1995) advocate the practice of reviewing draft items with teams of language teachers to reaffirm needs analysis research practices and content validation of draft tests. The researchers (Alderson, Clapham & Wall, 1995) support the credence of experienced teachers in professional contexts where the items are developed for CRT-achievement tests. The final CRT-diagnostic and achievement tests have had inputs from experienced peers at the university who not only have subject expertise but also a good understanding of proposed test participants.

4.7.1 Test Items

The tests are designed to measure diagnostic vocabulary proficiency, both receptive and productive in nature. Receptive language information is obtained relatively efficiently and quickly through *selected-response items*, which are most suitable for testing receptive skills in language such as reading or listening (Brown & Hudson, 2002,p. 64).

"In *selected-response items* the respondents, choose the correct response from a set of supplied options. The most common form is the multiple choice item…" (Brown & Hudson, 2002:59). For selected-response items, the respondents are able to choose possible answers from a list called the *options* or *alternatives,* the correct answer is called *the key* and incorrect alternatives are called *distractors* (Brown & Hudson, 2002:59). The distractors selected for the tests follow a model recommended set by National Assessment Governing Body (NAGB, 2005 ; Salinger et.al., 2005 as cited in Pearson, Hiebert and Kamil, 2007, p. 293) as shown in the following section.

Distractors as defined in the context of the pre-tests-	
a)	a word that has a more common meaning of a target word, but that must be ignored in favour of the meaning in context.
b)	A word that presents correct information or content from the text that is not what is meant by the target word.
c)	A word that has an alternative interpretation of the context in which the target word occurs; or
d)	Other words that look or sound similar to target words

The target words definitions and distractors for the current pre-tests were taken from the *Longman Dictionary of Contemporary English (2003)*.

4.7.1.1 Part- 1

The first section of the test Part-1 measures receptive skills of reading through multiple test items via which the respondents are tested for lexical knowledge. The respondents are asked to select the meaning of words most frequently used in the reading test, from a list of possible options and distracters along with an *item-stem*, which will serve as a prompt such as, *"according to the article"*.

Example: According to the article, *power* means:

Choice of answer:
  a) *ability*
  b) *energy*
  c) *strength*
  d) *authority*

The first task requires respondents to define terms used in the text. This exercise necessitates recognition skills and lexical knowledge correlated to receptive vocabulary proficiency. Four items from the first text and five items each from the second, third and fourth text; a total of 19 items, test recognition skills and lexical

knowledge using the most frequently used words in the texts. The items selected correspond to the frequency of their usage within the texts and are expected measure receptive skills of participants efficiently as they are the most frequently used words in the text. A number of words are tested for receptive skills using multiple texts. Vocabulary researchers recognise that testing in context require using reading or listening comprehension texts which in turn reduces the number of items that can be included (Read, 1993, p.357). The benefit of testing in context is that one is able to verify that the test-takers have actual knowledge of the words tested, the test is presented in a meaningful context, and that one could establish how well they knew the words (Read, 1993).

Read (2000; 2007) further advocates the practice of testing in context. He states that it is better to conduct an in-depth probe on a limited number of words in context than test vocabulary size on an overall superficial level. Alderson, Clapham and Wall (1995) state that reading tests should contain between 40 and 50 items and that each item should be worth about 1 mark. The current tests consist of a total of 53 items which strengthen their validity and permit the researcher to test participants in context. The multiple approach to testing employed in the current CRT diagnostic and achievement tests (multiple choice, gap filling, sentence completion) reduces the *method effect* in test participants. *Method effect* is defined by Alderson, Clapham and Wall (1995) as the influence of a particular type of testing which affect a test taker's score.

The tables (4.*5*), (4.*6), (4.7) and (4.8)* show lists of most frequently used words in texts (1), (2),(3) and (4).

Words	Frequency
Power	7
Grid	3
Utility	3
Solar	3

4.5 Table of most frequent words in text (1)

Words	Frequency
Cell	4
Stratosphere	3
Satellite	3
Powered	2
Fleet	2

4.6 Table of most frequent words in text (2)

Words	Frequency
Technology	4
Install	3
Enhancement	2
Breakthrough	2

4.7 Table of most frequent words in text (3)

Words	Frequency
Panels	7
System	6
Engineering	4
Thermal	3
Typical	3

4.8 Table of most frequent words in text (4)

The above words test knowledge of meaning to measure the participants' receptive vocabulary and lexical knowledge.

4.7.1.2 Part-2

The second section of the test, Part-2 tests depth of vocabulary knowledge and use and requires respondents to select the appropriate word from a list of words for sentence completion. The words selected from the article have been used in different contexts and for some responses; the test participants require knowledge of derivatives of words used in the text in order to answer them accurately. The section uses *constructed-response items.* Brown & Hudson (2002, p.64) state that constructed-type responses are more appropriate to measure productive language information and recommends tasks that require respondents to write a phrase or a word to answer an open-ended question which may include fill-in and other performance tasks . Five items each from text (1), text (2), text (3) and text (4) are tested in this section from a selection of least frequent words used in the texts in addition to distracters.

Example: Most _____ fuels are produced from renewable energy sources or at least sustainable energy sources.

Black outs, subsidy, self-sufficiency, **alternative**, generated, reliability, solar, electricity, satisfaction, power rates

McCarthy (2007, p.2) states that with advanced level vocabulary acquisition, the focus should be on the ability to use "less frequent, extended, and metaphorical senses of words and the creation of new relationships among words". Depth of knowledge in vocabulary, is defined by McCarthy (2007) as the knowledge of various aspects of a word, including collocations and sub senses. Vocabulary researchers (Haastrup & Henriksen, 2000; Henriksen, 1999; Meara,1996 as cited in McCarthy,2007) acknowledge that increase in depth of knowledge can be interpreted as the capacity of the learner to form links between words and the ability to place them meaningfully within systems in relation to other words. Other researchers like Read (1993) agree that depth of knowledge shows how well test takers know particular words.

Task 2 would be able to successfully measure the depth of vocabulary of test participants, as the test requires understanding of derivations of the least frequent words from the text. This section tests the five least frequent content words used in the text (1), text (2), text (3) and text (4).

Content words in text	Frequency of occurrence
Reliable	1
self-sufficient	1
alternative	1
generator	1
blackouts	2

*The word blackouts has been used twice

4.9 Table of least frequent words in text (1)

Content words in text	Frequency of occurrence
Conventional	1
Altitude	1
Efficient	1
Incentive	1
Remote	1

4.10 Table of least frequent words in text (2)

Content words in text	Frequency of occurrence
Stability	1
Non-toxicity	1
Absorber	1
Technique	1
Convert	1

4.11 Table of least frequent words in text (3)

Content words in text	Frequency of occurrence
Ubiquitous	1
Durable	1
Viable	1
Utilize	1
Array	1

4.12 Table of least frequent words in text (4)

Part-2 tests learners on primary use of words as well as derived use of words from the text. Part-2 of text (1) *Item (1)*, tests participants on the word *reliable* in a different context Similarly, *Items (2) and (4)* of Part-2 test participants on derivational knowledge of words. Presently, there is very little empirical evidence to illustrate that if learners are familiar with the base form of a word, they would understand inflected or derived forms of the words (Beglar and Hunt, 1999). Part 2 of text (2), *Items 1, 2, 3, 4*

and 5 further validates the depth of vocabulary knowledge in study participants. Similarly, Part 2 of text (3) and text (4) tests participants' depth of vocabulary through the usage of least frequent words in the texts in different contexts. Vocabulary breadth tests measure primary meaning of words and word families known by learners. Vocabulary depth tests learners on word use in different contexts. The current tests measure knowledge of derived forms of words and in different contexts. The usage of multiple texts serves to increase reliability and validity of the CRT-type tests.

Qian (1999) states that knowledge of primary words can include knowledge of polysemy, synonymy and collocation, and that constructs of breadth and depth of vocabulary overlap partially. Qian's studies (1999) reported on Korean and Chinese learners of English. Significant and positive correlations between vocabulary size and reading comprehension have been reported in various studies (Qian ,1999; Beglar, 2000). Qian (2002) affirms that vocabulary depth is as vital as vocabulary size in predicting performance on academic reading. Part C tests the participants on the ability to explain technical vocabulary used in context. Three phrases each from text (1), text (2), text (3) and text (4) that relate to the main ideas of the texts are used for this task. Productive vocabulary skills of test participants are measured through this task in all the four tests.
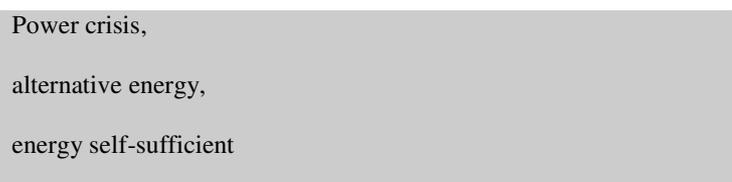
Power crisis,

alternative energy,

energy self-sufficient

Fig. 4.2 Phrases and terms significant in text(1)

High performance;

Wireless communications;

Prototype

Fig. 4.3 Phrases and words significant in text(2)

| Silicon wafers; |
| Light absorption; |
| Wavelength |

Fig. 4.4 Phrases and words significant in text (3)

| Greenhouse gases; |
| Emissions; |
| Two-dimensional |

Fig. 4.5 Phrases and words significant in text(4)

Brown & Hudson (2002) maintain that test items, which are units of measurement, must be quantifiable either through objective scoring or through subjective evaluation. Part A and Part C of the current test will be measured through evaluation. Part B uses dichotomous type of scoring (either right or wrong type of answers). All sections require the test taker to provide a *constructed type response* (including fill-in and short answer type responses) in order to demonstrate vocabulary proficiency. Constructed-response items require the test taker to produce language and are used for measuring the interaction of receptive and productive skills as in the interaction of listening and speaking or in the interaction of reading and writing (Brown & Hudson, 2002). The text is based on specific technical content that corresponds to English for Academic Purposes (EAP). Fulcher (1999: 222) states that in EAP testing "validity translates into the degree to which the test accurately samples from the course of study or domain". The text sample uses topics and themes relevant to the course of study of participants.

4.7.2 Attrition of testing items

The attrition of test items is acknowledged, following the trialling of the test items, especially in items that measures definitions of most frequent words occurring in

the text. This was anticipated as the CRT-diagnostic, and CRT achievement vocabulary tests are context dependent. It has been widely accepted by researchers that contextual testing would limit the number of items to be tested (Read, 1993). However, raters were invited to suggest more words from the texts to achieve the purpose of testing receptive vocabulary and recognition of words. The words presented are the final lists of words selected for the CRT-diagnostic and achievement vocabulary tests.

4.7.3 Scoring criteria and Inter-rater Reliability

The steps which have been taken to ensure maximum validity for the test items and scoring evaluation are as follows:

1. All items checked by subject area specialists.
2. Respondent raters providing reasons why they gave answers to test items the way they did.
3. Refining or changing items based on raters' recommendations.
4. Raters' agreement on matching test items to what aspect it tests.
5. Pretest the test on students who are similar as possible to the target group.

4.7.4 Section 1- Scoring

For Part 1, Reading for Meaning, the first task requires students to define terms used in the text. This exercise requires recognition skills and lexical knowledge correlated to receptive vocabulary proficiency. Receptive language information is obtained through *selected-response items,* which are multiple choice items. The raters are expected to review the correct answers and distracters provided and provide suggestions or affirmations.

Part 2-Test for measuring depth of vocabulary knowledge tests learners on primary use of words as well as derived use of words from the text. It tests depth of

vocabulary knowledge and use and requires respondents to select the appropriate word from a list of words for sentence completion. The raters (experienced native speakers who are lecturers of academic writing in English) commented on the suitability of the text and test items. In the final section Part C-reading for technical vocabulary, for example the item as given below:

Explain in your own words what a *"power crisis"* means in the context of the article.

It was expected that the test taker would explain what power refers to, as well as what a crisis means in the context of the reading to enable the raters to assess the test taker's understanding of the phrase in context. Read (as cited in Sanchez & Manchon, 2007) recommends the notion of an "interactionalist" vocabulary test which is able to assess the ability of the learner to make effective use of lexical resources in specific contexts of use.

Table 4.13 shows a summary of the reading texts, test items selected and types of vocabulary knowledge measures and their functions.

Table 4.13 Summary of test items

Text	Items selected	Task	Skills Measured	Types of Vocabulary knowledge	Lexical frequency
Off the Grid with solar power	power, grid, utility; solar	Word definitions MCQ	Recognition skills Lexical knowledge	Receptive vocabulary	Most frequent words
Off the Grid with solar power	reliable self-sufficient alternative, generator; blackouts	Sentence Completion Gap-fill task	Depth of vocabulary knowledge meaning in different context	Productive vocabulary	Least frequent words
Off the Grid with solar power	Power crisis Alternative energy Energy self-sufficient	Defining meaning	Technical vocabulary	Productive vocabulary	Important Concepts
Solar Flyer	cell, stratosphere, satellite, powered; fleet	Word definitions MCQ	Recognition skills Lexical knowledge	Receptive vocabulary	Most frequent words
Solar Flyer	conventional altitude, efficient incentive; remote	Sentence Completion Gap-fill task	Depth of vocabulary knowledge meaning in different context	Productive vocabulary	Least frequent words
Solar Flyer	High performance, Wireless communications; prototype	Defining meaning	Technical vocabulary	Productive vocabulary	Important Concepts
Efficiency Boost Makes Solar Cells Cheaper	technology, install. enhancement; breakthrough	Word definitions MCQ	Recognition skills Lexical knowledge	Receptive vocabulary	Most frequent words
Efficiency Boost Makes Solar Cells Cheaper	Stability Non-toxicity Absorber Technique convert	Sentence Completion Gap-fill task	Depth of vocabulary knowledge meaning in different context	Productive vocabulary	Least frequent words
Efficiency Boost Makes Solar Cells Cheaper	Silicon wafers; light absorption; wavelength	Defining meaning	Technical vocabulary	Productive vocabulary	Important Concepts
Inventor, Engineering Students Explore New Solar Collectors	panels, system, engineering, thermal; typical	Word definitions MCQ	Recognition skills Lexical knowledge	Receptive vocabulary	Most frequent words
Inventor, Engineering Students Explore New Solar Collectors	Ubiquitous Durable, Viable Utilise; array	Sentence Completion Gap-fill task	Depth of vocabulary knowledge meaning in different context	Productive vocabulary	Least frequent words
Inventor, Engineering Students Explore New Solar Collectors	Greenhouse gases, Emissions; Two-dimensional	Defining meaning	Technical vocabulary	Productive vocabulary	Important Concepts

4.7.5 A priori validation

The texts and test items were selected following a number of procedures such as the following:

1. Review of research and theories of reading
2. Studies of various assessment models
3. Analysis of topic familiarity and relevance of texts
4. Analysis of test items
5. Allowing for attrition in items by trialling extra items
6. Rating of test items and text selections by experts

4.7.6 A posteriori validation

The text construction also applied the following a posteriori procedures:

1. Marker reliability for texts selected
2. Marking schemes / rubric rating through inter-rater reliability
3. Trialling on reasonable sample

The final draft versions of the tests were reviewed by five experienced teacher academics including the researcher.

The marking of the tests have been conducted in teams provided with clear rubrics.

4.8 Exploratory Data Analysis / Descriptive Data Analysis

Descriptive statistics permit researchers to organise, summarise and describe observations efficiently and establish how researchers can consistently infer that those phenomena observed in a limited group or a sample will also take place in the unobserved larger population (Ary, Jacobs & Razavieh, 2002). Although the present

study does not claim 'open' generalisations, it claims 'closed' generalisations from the inferences drawn from the study according to Bassey's definition of 'closed' generalisations (as cited in Opie, 2004: 5) which explains that in 'closed' generalizations, without essentially extrapolating the data beyond observed results the researcher can draw inferences to relatatability. This view is espoused by Opie (2004) who stated that it is a distinct way in which an observable fact closely resembles what happens in another similar educational setting.

4.8.1 Pre-tests and Post tests-Validity and Reliability

The experimental and control groups must be comparable in all variables that may affect the independent variable and should differ only in exposure to the 'independent variable' (Ary, Jacobs & Razavieh, 2002), which in this context is the explicit teaching of the vocabulary strategies identified earlier on in phase one of the study in combination with well established vocabulary teaching strategies. Using control groups permit the researcher to disregard many alternative explanations for the effect of the treatment (Ary, Jacobs & Razavieh, 2002). Four CRT-diagnostic pre-tests were administered in six groups of students in a first year engineering undergraduate programme. Two pre-tests were administered in week one and the following two pre-tests were administered in week two of the semester to the same group of students and the reliability coefficient was calculated to test consistency of scores. This practice of administering the CRT-diagnostic pre-tests in two sessions was adopted in order to avoid test fatigue in students and consequently enhance the internal consistency in the scores attained by test takers. Test reliability refers to the consistency of scores students receive on alternate forms of the test which may differ based on environmental variables such as fatigue or student error in responses which results in no two sets of scores being identical, with the results that the more comparable the scores are, the more reliable they are (Wells & Wollack, 2003). Reliability of the tests provides the extent to which a test taker's scores reflect random measurement error and therefore is an antecedent to test validity (Wells & Wollack, 2003). A 'true score' is obtained if an average score is taken

out of a number of test administrations and for this purpose reliability coefficients are used to estimate both true and error variance with observed test scores (Schultz & Whitney, 2005). A score of zero (0) coefficient reliability would indicate no reliability and a value of one (1) would indicate perfect reliability and a common standard of a reliability estimate of .70 or higher indicates good reliability (Schultz & Whitney, 2005). The most accepted index conducted for reliability coefficient is referred to as Cronbach's alpha which provides a measure of the extent to which the items on a test provide consistent information about the student's mastery of the knowledge (Wells & Wollack, 2003).

It is considered good practice that the Cronbach alpha be at least .70 or higher on class-room tests for higher internal consistency (Wells & Wollack, 2003; Schultz & Whitney, 2005). Similar CRT-diagnostic vocabulary tests were administered to both the control and experimental groups at the end of the teaching semester to evaluate the effectiveness of the treatment or intervention and to validate the conceptual vocabulary model developed by the researcher subsequent to phase one of the study. Evaluation followed the measurement to investigate if there were any differences in the vocabulary proficiency scores of the control and experimental groups. The pretest-posttest design is a superior test that endorses that the researcher gathers pre-experiment information regarding the status of those selected for participation in the study. This information is helpful in making it possible to ascertain credibility to the findings (Wiseman, 1999).

The design for the pre and post tests involving two control and two experimental groups adapted from Ary, Jacobs & Razavieh, (2002) is represented in figure 4.6

Two Groups Pretest-Posttest Design		
Pretests	Independent Variable	Posttests
Y1	X	Y2

Figure 4.6 Two groups pretests-poststests design

Ary, Jacobs & Razavieh (2002:327) state that experimentation with controlled conditions is the most rigorous and most desirable form of scientific enquiry for the following reasons:

1) They can manipulate or vary the conditions systematically and note the variations in results;
2) They can make the event occur at a time when they are prepared to make accurate observations and measurements; and
3) They can repeat their observations under the same conditions for verification and can describe these conditions so that other researchers can duplicate them and make an independent check on the results.

In the present study the use of control and experimental groups, the two group pretest-post tests design, and coefficient reliability measures to enhance internal consistency of test scores ensures a systematic and rigorous analysis of the phenomenon studied. In addition, the development of specific CRT- diagnostic and achievements tests by the researcher for measuring vocabulary proficiency enhances the validity and reliability of the findings and test results.

4.8.2 Measuring location

The two group pre-test-post-test design employed in phase two requires analysing and interpreting scores obtained in the CRT-diagnostic and CRT-achievement tests undertaken by control and experimental groups of participants. The scores were evaluated and central tendencies recorded.

A measure of location or central tendency is a convenient way of describing a frequency distribution by means of a single value, and is a measure of quantitative data

which summarises how the data is centred together (Hussey & Hussey, 1997; Opie, 2004). The measures of location in common use and applied in the present study are:

mean ($\bar{x}$), median (M) and mode (m). See Appendix K for explanations of the descriptions of location measurements as applied in the study.

Standard deviation is a key statistical measure of variability that demonstrates how considerable the distribution of scores is from the mean (Opie, 2004). Most synthesists agree that by pooling the standard deviations between the two groups under comparison, the most accurate estimate of the population variance is achieved (Norris & Ortega, 2006). The variance and standard deviation provided in the study presents a depiction of the variability of the data. The mean, median, and mode are descriptive statistics which provide us with a view of where the approximate 'middle' of a set of data lies and are measures of central tendency.

In the study, the central tendencies and standard deviations from the pre-tests and post tests are presented in the findings section to describe the statistics according to the definitions given, to clarify scores attained by the control and experimental groups and for clear comparisons. Norris and Ortega (2006) stated that among the key factors that are commonly missing from language learning and language teaching studies (LL & LT) are descriptive statistics which is essential for combining or comparing/contrasting findings across studies in a reliable manner and for basic contextualization which is essential for positioning and interpreting findings. The authors (Norris & Ortega, 2006) claim that descriptive statistics were particularly essential for contextualisation of indicators of learners' L2 proficiency levels and for sufficient descriptions of instructional treatments.

4.8.3 Independent Samples t-Tests

The *t*-test is a parametric technique which can be used for either independent or related samples. Statistical investigations involving controlled experiments often compare the parameters of two populations, usually the means (Chen, 2005). Separate samples are selected from each population. One sample may be referred to as the control group and the other the experimental group. When making inferences about the means of the populations, the actual observations may have come from independent (unrelated samples) or matched-pairs (related) samples. Data must be of interval status which refers to a measure which permits data to be placed precisely along the scale and determines exactly what the intervals are.

Appendix J explains the *t*-test equation and representations as applied in the study.

By examining the different scores using *t*-tests a researcher is able to understand if the post tests results in experimental groups have had any increments or not. Sanz (2005) stated that an often encountered design in second language acquisition (SLA) research is a comparison of the performance between an experimental group and a control group to evaluate the effectiveness of a certain treatment. Sanz (2005) asserted that the independent samples *t*-test is appropriate in research designs with two groups of participants with each participant contributing a score in the test. The present study uses the independent samples *t*-tests to ascertain and clearly explain the comparative scores obtained from the pre-tests and post-tests in control and experimental groups and to demonstrate if the intervention or treatment in the experimental groups is effective.

4.9 Limitations of the Study

Although this study sheds light on the inherent vocabulary development patterns in adult L2 tertiary learners it is not without limitations.

Firstly, in phase one, the study analysed data on the various vocabulary inferencing strategies applied during reading, which were gathered from a representative sample of 41 participants. The researcher had provided participants with detailed written instructions on retrospective and concurrent verbal protocol. In addition, a set of written probe questions to guide thoughts and reflections was also given. Nevertheless, as admitted by some of the participants, they may have experienced difficulties in expressing their thoughts with clarity in English as some of them are more at ease at communicating in their own L1. However, as possible in qualitative research, the data provided by participants while considered highly valuable may have inadvertently excluded some aspects which make the findings situational yet legitimate.

Secondly, in phase two of the study, although the participants in the study were assigned randomly by the faculty and the control groups were taught by an experienced colleague according to standard teaching procedures outlined for the unit by the faculty, it is possible that the levels of enthusiasm generated in the classes could be different. The levels of satisfaction by the students are measured through feedback systems put in place by the university, however, the unit satisfaction is expressed as a whole for all groups and individual teaching satisfaction feedback is available only to individual teachers, and not disclosed to colleagues. So it is not possible to measure the levels of enthusiasm or satisfaction in each group per se. Comparison groups, experimental and control are essential in educational research to compare groups receiving alternate treatments. The researcher had ensured that the groups receiving treatment in the experimental were homogenous and that the experimental and control groups were equivalent in all levels except in the exposure to the independent variable which in this case is explicit instruction of vocabulary learning strategies. Conditions for extraneous variables had been accounted for by the researcher. However, as the groups were taught by different instructors, it is possible that students could respond to factors other than that of teaching such as the attitude, care and enthusiasm of the different instructors. Equivalency of the groups had been accounted for prior to the randomised selection of experimental and control groups, and as required in an experimental study,

the independent variable was the explicit instruction of vocabulary learning strategies as explained earlier.

4.10 Ethical Issues

In conducting this study research ethics for maintaining the participants' confidentiality and sampling criteria were considered. National Health and Medical Research Council, (NHRMC) guidelines for conduct of research involving humans were considered carefully in the design and execution of the present study. Various aspects such as informed consent, confidentiality, anonymity and privacy were maintained for all the participants taking part in the research studies. Adequacy of method was followed carefully to ensure that the case studies portray accurately and objectively students' responses, beliefs, knowledge and skills so as to bring positive advancements in the field of vocabulary research.

Written permission to conduct research was obtained from the Research Ethics Committee at Curtin University of Technology, Perth, WA. The researcher has accounted for confidentiality and anonymity of the participants in the study through de-identification processes using numbers instead of names of participants. Informed consent was obtained from the study participants prior to verbal protocol being collected through letters of consent. Participants were able to make decisions on whether to participate in the study or not through detailed descriptions of the study its purposes and potential significance provided in the letter of consent. A letter of consent is an indication to the fact that participants have an open choice about whether they wish to participate in the study (Wiseman, 1999). It is recommended that informed consent is obtained for ensuring that participants understand what it means to participate or not in a particular research study and is also an important way in which to ensure respect for participants during research studies (Mackey & Gass, 2005).

4.11Data Storage

The data generated by this research project include tape recordings of verbal protocols, researchers' notes, raw data and processed data in computer files, and responses to instruments applied to the participants taking part in the research project. In accordance with the recommended guidelines, all primary data will be stored, securely, by the supervisor for a minimum of five years after the completion of this course. Appropriate security will be ensured for all information collected, including that held by computer systems.

4.12 Significance of the Study

With more second language learners (L2) entering universities where English is the medium of instruction, there is a need for research into the processes underlying language performance in a second language (Chaudron, 1988). This study has examined how inferencing strategies influence vocabulary development in second language learners. The study contributed to existing knowledge in L2 vocabulary acquisition patterns in general and to the development of better pedagogical practices that may positively influence vocabulary learning in L2 learners. Vocabulary research in second language acquisition (SLA) has examined how linguistic and communicative competence; the ability to interpret the underlying meaning of a message, understanding cultural references, using strategies to keep communication from breaking down, and applying the rules of grammar, develops in a second language (Savignon, 1997). Emerging findings from this research study have provided insights into the lexical and inferencing strategies applied for vocabulary development from context which has been described by L2 vocabulary researchers as "difficult to capture and remains poorly understood" (Paribakht &Wesche, 1999, p.196). The study has identified 16 lexical and vocabulary inferencing strategies through the first phase. Four new strategies or variants of strategies were identified through the study. Empirical evidence in phase two of the

study established through quantitative methods have verified that explicit teaching of vocabulary learning strategies and raising meta-cognitive awareness of vocabulary learning advances vocabulary production in L2 learners thus verifying the L2 PR-PV vocabulary development model. Therefore its impact on teaching is undeniable.

Firstly, the research has contributed to knowledge regarding the role of context in the inferencing procedures of L2 learners. Word knowledge is an essential component of communicative competence, and it is important for production and comprehension in a second language (Coady & Huckin, 1997). Most vocabulary studies in the past have almost exclusively focused on how recognition and the number of words known changes over time. This focus on the growth of the overall sight recognition of words has left the question of context on the inferencing strategies of the L2 learners in relation to acquiring vocabulary almost completely unanswered. The absence of research evidence in lexical associations by L2 learners has made L2 theorists draw on L1 models (Channelle, 1999). The study has provided the L2 PR-PV model of vocabulary development as a basis for further studies in this area of research. The study has illustrated the way in which L2 learners use diverse lexical and inferencing strategies to construct meaning during reading through elicited verbal reports which provided understanding on the reasoning processes underscoring the importance of cognition, response and decision making. The verbal protocols provided in-depth knowledge on various processes occurring during inferencing in L2 learners exemplifying a pattern of vocabulary development in L2 learners. In addition, the study has provided L2 learners a chance to articulate inferencing/ lexical strategy usages and beliefs of what constitute the development of mental lexicon.

Secondly, the study has made available knowledge concerning the strategies employed by L2 learners while progressing from a *pre-receptive* stage to a productive stage taking into account their prior knowledge of vocabulary. The findings from the research illustrate how L2 learners manage the task of lexical acquisition particularly

with a view to consolidating knowledge of words from a receptive to the productive stage. The research findings also contribute to knowledge regarding the L2 learners' mental representations of word meanings and establish links between the *pre-receptive* and productive processes in vocabulary acquisition. This knowledge is significant as in previous studies conducted, it was presumed that L2 vocabulary learning occurs along a continuum of knowledge or trajectory, beginning from receptive knowledge of a word to productive knowledge, where reception comes before production (Waring, 2002). The present study also draws attention to the L2 learners' *pre-receptive* stage of vocabulary development which is new notion previously unexplored in research in L2 vocabulary studies. While acknowledging that receptive knowledge of vocabulary occurs before production stages, the present study emphasises that the process of moving from *pre-receptive* to productive stage of vocabulary is not sequential.

Thirdly, the research findings from the present study contributed to knowledge of vocabulary acquisition in a social context involving the mediated learning experience, where collaboration and active learning was encouraged. In constructivism, learning is understood to be a method of conceptual change. The research findings inform the development of instructional methodologies that are appropriate in facilitating vocabulary development in L2 learners. Researchers have studied the non-linguistic influences on SLA such as age, anxiety and motivation (Pica, 2003; Gass and Selinker, 2001; Ellis, 1997). But, research on L2 vocabulary learning in academic learning contexts is meagre and has been complicated by the presence of diverse learners and varied learning contexts. The present study contributes to knowledge of procedures by which L2 learners convert receptive vocabulary into productive vocabulary and make them part of their mental lexicon in a social realm. It was interesting to note how the L2 learners in experimental groups in the study advanced critical awareness of vocabulary learning strategies and how they adopted appropriate strategies illustrating that this community of learners were efficient in developing proficiency and advancement of vocabulary.

Further, the study seems to confirm the notion that an 'interactionalist' type (Read, 2007) of vocabulary test that assesses the capacity of the L2 learner to make effectual use of lexical cues in specific linguistic contexts is necessary for evaluating vocabulary proficiency in L2 learners. The thesis was able to develop proficient vocabulary assessment tests in L2 learners that tested vocabulary in context. The CRT-diagnostic and achievements tests developed in the study measured both depth and breadth of vocabulary knowledge and technical vocabulary knowledge in tertiary adult L2 learners. The types of vocabulary knowledge measured in the CRT-diagnostic and achievement tests ranged from receptive to productive vocabulary knowledge and focussed on recognition skills, lexical knowledge, depth of vocabulary knowledge to ability to discern meanings in different contexts, and technical vocabulary. The lexical frequency of the items in the CRT-diagnostic and achievement tests ranged from most frequent words in the texts to least frequent words in the texts and included important concepts explored in the texts. It is hoped that the present research findings on L2 vocabulary assessment will provide directions for the development of more effective vocabulary assessments in context.

4.13 Summary

This chapter has provided an overview of the research design applied in the study. It has summarised the statements of research objectives and methods employed and described the research design or the conceptual research framework, and further analysed the research paradigms and viewpoints pertinent to the study. The data selection procedures and criteria applied in the study were then presented followed by a discussion of the prior educational experiences of participants with which they entered the study, the sampling methods, the data collection methods and rationale for using such methods, and finally the data analysis procedures, in particular the measures adopted to enhance the internal consistency of the scores obtained on the pretests and posttests administered in the control and experimental groups. The chapter has also provided details of the significance of the study.

The next chapter will discuss the findings in phase one of the study to respond to research objective one and focus particularly on the inferencing strategies identified through the present study.

Chapter-5 Findings and Discussion for Research Objectives One and Two- Inferencing Strategies and Conceptual L2 Vocabulary Development Model

This chapter presents the findings and discussions concerned with the first phase of the study which deal with elicited information on vocabulary development patterns and inferencing strategies in L2 learners. It provides descriptions of the data analysis, codes and themes identified and summaries of the inferencing strategies that study participants employed during reading tasks. The chapter concludes with the discussion of the conceptual theoretical model of L2 vocabulary developed.

5.1 Major Inferencing Strategies Identified Through Verbal Protocols

5.1.1. Findings in Relation to Objective 1

This section reports on findings in relation to the first objective of the study. The analyses of the transcribed verbal protocols from retrospective self reports and concurrent reports indicate that a range of strategies, such as memory, cognitive, meta-cognitive and social inferencing strategies were used by study participants during reading. Analyses of the transcribed protocol profiles were exploratory-interpretive, with the aim of categorising participants' inferencing strategies. A total of 16 major inferencing/ vocabulary learning strategies were identified from the verbal protocol analysis. Sub categories arising in some inferencing strategies were defined and numbered using decimal notations. Four new strategies or variants of strategies were observed to have been used by the participants. Each inferencing strategy was identified as whether they correspond to memory, cognitive, meta-cognitive or a social strategy. While working on the thematic descriptions of strategies, it became clear that each participant had used inferencing strategies in unique and individual ways. Therefore, the definitions of each strategy reflect how each participant had used

inferencing strategies and how these relate to descriptions of theoretical units of analysis.

Table 5.1 summarises the various strategies employed by the L2 participants and theoretical units of analysis.

Table 5.1 Summary of Vocabulary Development Strategies Identified-Theoretical Units of Analysis

No.	Strategies	Definitions	Definitions	Definitions
1	Text Processing *Meta-cognitive strategy	noticing unfamiliar words	Focussing on text and meaning	
2	Context Analysis 2.1) connecting words between new and known words 2.2) connecting meaning 2.3) Using background knowledge or domain/discipline knowledge to infer meaning 2.4) registering satisfaction with assimilation (new strategy identified) *Syntactic strategy/ Memory strategy	Through this method students may develop inferential word learning Students become accustomed to monitoring their own comprehension New strategy identified	The context in which words are learned is very important. Vocabulary words should be words that the learner will encounter in many contexts because students learn new words better when they encounter them often (Armbruster et al,2001)	Knowing a word means not only knowing its definitional relations with other words, but also being able to interpret its meaning in a particular context (Stahl, 1999). Linguistic and extra-linguistic clues (Pulido,2007) *Table continued overleaf*

3	Morphemic Analysis *Cognitive strategy 3.1)Conscious of word parts 3.2)An understanding and interest in words and how they are used		Awareness of learning through use of prefixes, suffixes etc.	Morphological information used to obtain clues about word class(Pulido, 2007)
4	Structural Analysis Strategy *Syntactic strategy/memory strategy integrating new linguistic information into developing systems	Higher level decoding and inferring meaning	Syntactic information used for text processing(Pulido, 2007)	
5	Repetition and multiple exposures to words contribute to students' understanding of word meaning *Cognitive-social strategy	Words are typically learned from repeated encounters (often 8-10 exposures), rather than from a single context or encounter (McKeown, Beck, Omanson, & Pople, 1985).	Students generate explanations through multiple exposures to words. (Marzano, Pickering & Pollock 2001).	
6	Referring to the Dictionary (Monolingual / bilingual) *Semantic strategy/	The student refers to a dictionary to find meanings	Knight (1994), for example, discovered that while incidental	Knight (1994) found that low verbal ability participants benefited more from the dictionary than

	Memory strategy 6.1) for word meanings 6.2) for synonyms 6.3) for examples of word usage	of difficult words, or to find synonyms of words	vocabulary learning through contextual guessing did take place, those who used a dictionary as well as guessed through context not only learned more words immediately after reading but also remembered more after two weeks.	high verbal ability participants who, in turn, benefited more from contextual guessing.
7	Peer Learning / Social Constructivist Learning * Social learning strategy 7.1) asking peers 7.2) asking authority	Asking other learners who are more knowledgeable		
8	English for Specific Use *Memory strategy	Learning terms used in specific contexts or disciplines		
9	Limited Processing capacity Skip over words not deemed important Meta-cognitive strategy	Characteristic of lower proficiency learners(Pulido, 2007)	Superficial and limited processing (Pulido, 2007)	
10	Retaining new words depending on 'need' Meta-cognitive strategy	Motivational aspects	Concerns need to comply with task(Pulido, 2007)	
11	Retaining new words depending on 'search' *Meta-cognitive strategy 11.2 referring to internet search engines like google (New strategy identified)	Making attempts to determine the meaning of unknown (Pulido, 2007)words		

12	Retaining new words depending on 'evaluation' * Cognitive processing strategy	Making a decision about semantic and formal fit of word and its context(Pulido, 2007)		
13	Guessing Meaning of unknown words *Cognitive strategy	L2 learners use background knowledge to guess meanings of unknown words (Haastrup, 1989)		
14	Expressing lack of understanding *Meta-cognitive strategy	New strategy noted (researcher)		
15	Visualising *Memory strategy	New strategy noted (researcher)		
16	Transfer Processes *Memory strategy/Cognitive strategy	Translating from learners' L1		

Table 5.1 illustrates that some inferencing strategies have several sub-strategies. For instance strategy 2, which deals with context analysis, was allocated sub-categories according to the varying explanations for context analysis. The decimal notations in each sub-category were defined to explain the way in which they it was used as shown in the example for category 2:

2.1) connecting words between new and known words;

2.2) connecting meaning;

2.3) Using background knowledge or domain/discipline knowledge to infer meaning and;

2.4) registering satisfaction with assimilation, (which is a new strategy that I identified).

Throughout the transcription process, through coding procedures and inter-rater reliability, sub-categories were created and numbered so as to obtain an overview of all the inferencing strategies used by participants as discussed in the methodology chapter 4, section 4.3 this thesis. The following extract shows that if a sub-category of a strategy was noticed to have been used by a participant, the decimal notation illustrated the variation of strategy employed.

Please see appendix H on pages 294-304 and appendix I on pages 304-321 to see how participants were accorded numbers to distinguish them from other participants and also how strategies and sub strategies were numbered for ease of identification.

Extract ST-1 exemplifies how the data was gathered and provides a brief insight into the thematic analysis of the transcripts of participants' verbal protocol. The excerpt seems to indicate that study participant ST-1 employed a number of strategies to construct meaning from texts. It appears that the L2 learner while reading a text used context cues that integrate with literal word meanings of the text to construct a cogent understanding of the text.

I will read the whole sentence/ where the word is in the sentence[…](1.0) and then I'll try to understand the meaning// in the context(2.2) of the sentence[…] I will look at the title of the whole paragraph// and then I will read the sentence/ that I don't know or(3.0)// I'm not sure of and I'll read the whole article// (2.2)and try to put it in the context of the whole story[…]Usually, if I come across a lot of words, I've not learned before// after checking them in a dictionary /(6.1) I'll put their meanings[…] into the sentence and// I'll re read the article many times[…]by then, I think I will be able to get the meaning// I'll think in English first /and then I'll translate into Malay(16.0)[…]
ST-1= Participant 1

Text processing = Morphological or other information used to obtain clues about word class

Context analysis= connecting words between new and known words

Morphemic analysis= Conscious of word parts

Dictionary usage= The student refers to a dictionary to find meanings of difficult words, or to find synonyms of words

Translating into L1= transfer processes

In the extract given above the numbers indicate the type of strategies and the decimal notation for sub-categories of strategies given in the table summary of strategies.

The extract provided in the excerpt from the transcribed data provided by participant ST-2 in retrospective verbal protocol provides additional data regarding inferencing processes.

ST 2: / when I read articles /and come across difficult words/ what sort of strategies do I/ use to understand the meaning/ of words/
I like reading a lot /and whenever I come across new words like // the first thing I do is try to understand it from the sentence itself /(1.0)I read it over and over again and try to figure out the meaning/(1.0) in case I don't understand I try to find/ look up the words usually/ I use an electronic dictionary so/ if I get the meaning/ (6.1)I try to get the synonyms to understand the word better/(6.2)that's the strategies (sic)I usually use[…]
for the second question/ once you have understood the words/ do I use them in your own writing/ […] depending on the words definitely/ah/ some words if they're really eye/ catching and really interesting/(3.0) I'll definitely use them but not all words/ most times/ for example/ I got to learn words during my SAT(10.0)/ I came across a lot of words and as much as I was bound to learn them for my SATs/ I started using them in my own writing/ okay[…]
final question/when do I feel to// they have become part of your own vocabulary// when I start using them regularly/(10.0) yeah some words/ just as I said becomes eye-catching and I really/ like the words and I start using them//(3.2) ah/a word for example that I use regularly now is belligerent//or obnoxious /just because I really like the words and that's(3.2) why I use them in my vocabulary/ that's about it[…]

Text processing = Morphological or other information used to obtain clues about word class

Dictionary usage= The student refers to a dictionary to find meanings of difficult words, or to find synonyms of words

Morphemic analysis= Conscious of word parts

Retaining new words depending on evaluation= Making a decision about semantic and formal fit of word and its context

ST2=study participant number 2

It is interesting to note the high level of perception or awareness of vocabulary learning strategies, study participant ST-2 seems to possess. The notion of multiple vocabulary learning strategy usage was not new to the participant. Based on the transcribed data, the ability of the participant to describe precise words learned and the multiple strategies used, draw attention to the possible productive processes occurring through use of vocabulary inferencing strategies. A critical aspect of learning vocabulary is recognising how vocabulary is used and this knowledge is crucial in the development of mental lexicons. Morphemic analysis of words tended to have supported the recognition and retrieval processes required for formation of productive vocabulary and mental lexicons for participant number ST-2. The way in which the study participant ST-2 thought about words, imagined them and made them part of productive vocabulary bring to focus interesting aspects of vocabulary learning processes. In particular, the vignette shows some of the procedures involved in pre-receptive (PR) to productive processes (PV) of vocabulary learning as emphasised in this thesis. The lexical entries for this particular participant seemed to include information regarding the words' semantic, syntactic or phonological properties. It appears that the selection of strategies matched what the reading situation or text necessitated for this L2 learner.

5.2 Usage of Strategies Identified in the Study

Four new strategies were observed to have been used by the participants in the study. Four strategies were observed to have been used dominantly by study participants with frequency of usage ranging between 61-78%. From the concurrent verbal protocol analysis, both individual and group, as many as five to six strategies were documented to have been used simultaneously by participants during task performance such as reading technological texts. From the retrospective verbal protocol analysis, it was noted that participants benefited from a strong awareness regarding the inferencing strategies or vocabulary learning strategies, which augurs well for tertiary L2 learners of English.

Figure 5.4 shows a summary of the strategies identified in the present study and the frequency of occurrence in percent.

Figure 5.1 Vocabulary Learning Strategies Summary
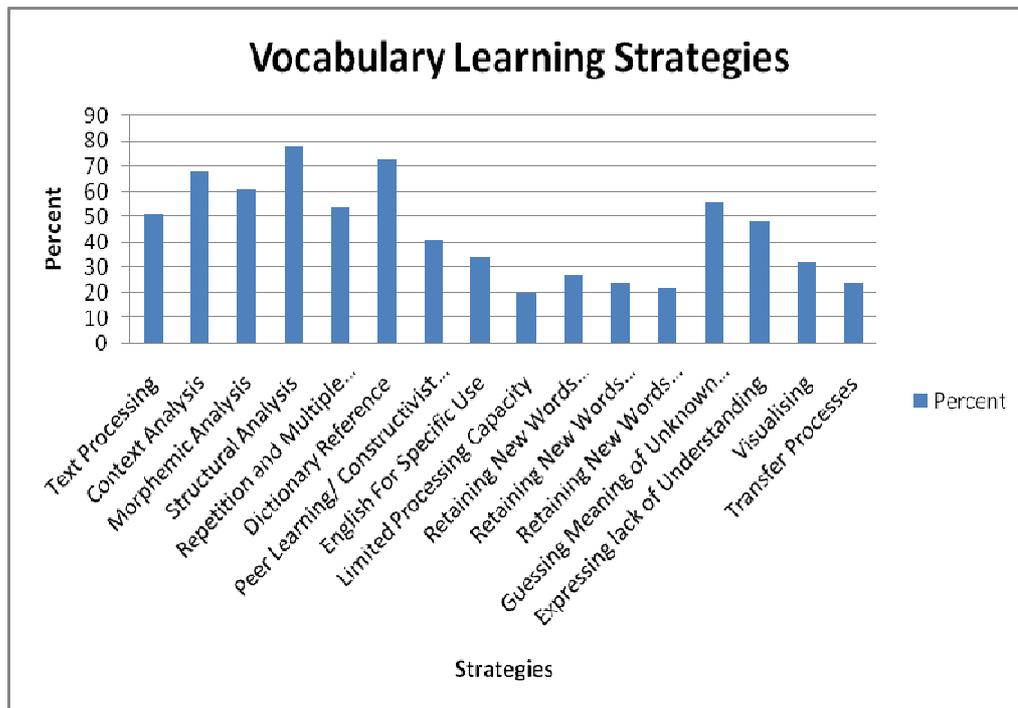
It is notable from the data analysis that prior lexical knowledge played a huge role in the selection of suitable inferencing strategy for the L2 learners. Figure 5.1 shows the frequency of usage of inferencing strategies utilised by study participants in the current study which were linked to numerous contextual cues available to the L2 learners, thus underscoring the significance of learning vocabulary from context. In addition to cognitive, meta-cognitive, and memory strategies employed by participants, social strategies such as asking peers and individuals in the social realm of learning required the learners to institute social communication with others, emphasising the constructivist domain of vocabulary learning. The structural analysis strategy was used most frequently by participants. This is a complex strategy that requires higher decoding skills indicative of the fact that the average of 12-13 years spent learning English as a second language tends to foster constructive

vocabulary learning strategies. This pattern is evident in the study participants. Encountering unknown words is arguably an impediment to meaning construction and comprehension, however how an L2 learner negotiates meaning and selects suitable strategies to move through receptive to production processes determine the development of mental lexicons. It is interesting to note that the L2 learners in the study reiterated their convictions of the use of many vocabulary strategies previously confirmed through research studies, such as repetition and multiple exposures to words leading to productive vocabulary, which deals with incidental learning. A schemata of pre-receptive to productive processes is shown in the conceptual theoretical model derived from the first phase of the study in the final section of this chapter.

5.3 Descriptions of Strategies

The descriptions and details of the major inferencing strategies identified through the analyses of retrospective and concurrent verbal reports are now provided.

5.3.1 Text Processing

Text processing is defined as what occurs when the L2 learners pay special attention to the unfamiliar words come across and focus on the text for meaning, which can be categorised as a meta-cognitive strategy. Meta-cognitive strategies involve selective attention and need to be self-initiated. Noticing the way in which words are written and paying attention to way they sound seem to influence the L2 learners, as illustrated in these retrospective self report protocols. A participant stated that attention is kindled when a word is seen as fascinating and 'really interesting'.

> ST2 "…depending on the words definitely/ah/ some words if they're really eye/ catching and really interesting" /

ST2= student participant no 2

Focussing attention to unknown words is also acknowledged to be a lexical strategy and may provide learners information as to how a word appears morphologically or, semantically.

ST 11 "Usually new vocabularies are hard to remember [*] especially words with many syllables".

ST11=student participant number 11

The ability to concentrate on words is a strategy related to text processing and this has been accounted for by participants in their retrospective verbal reports. The ability to notice words and deliberate on their forms is reported in other vocabulary studies as useful for increasing text comprehension and vocabulary. In text processing, the protocols showed an inclination and interest in how words appeared morphologically. This strategy provided self-direction to learners and was applied consciously. Twenty one (51%) study participants reported and were observed through protocols to use this strategy in the study.

5.3.2 Context Analysis

The context in which words are learned is very important. Through a context analysis strategy, students may develop inferential word learning and become accustomed to monitoring their own comprehension. Therefore this strategy is categorised as a syntactic strategy. In the study, using context analysis strategy the participants connected words between new and known words. They used background or domain knowledge to understand meanings of new words and they also registered satisfaction with assimilation. To know a word the L2 learner had to make meaning relations with other words and also be able to interpret meaning in a particular context and use context cues as seen in the following example.

ST 1 "I will read the whole sentence, where the word is in the sentence // and then I'll try to understand the meaning in the context of the sentence".

ST1= participant no 1

ST21 "I will usually have a rough idea of what it means from the context of the passage"

ST21= participant no 21

The ability to predict meaning intuitively from context also seems to play a role in text comprehension based on the excerpt from study participant number 21.

From the concurrent verbal protocol obtained while reading the technical article "New Mexico Unveils Spaceport Design"(See Appendix 5.1), participants registered satisfaction with the assimilation of the knowledge of the new word as identified in the analysis conducted on concurrent protocol as seen in the transcripts of protocol analysis given.

ST 26 Low lying look will be environmentally friendly, architects say / okay// New Mexico unveils spaceport design (stresses word design) spaceport //interesting// -
ST 26   Spaceport//something like international space station […]

ST26=student participant number 26

From the excerpts from ST=26, it was possible to view how the learner made connections to the word 'spaceport' through a link with the phrase 'space station' and used underlying background knowledge or domain / discipline or pre-receptive knowledge of the topic to arrive at a deductive inference of meaning. While using context analysis, the participants demonstrate that knowing a word means not only knowing definitional relations with other words but also being able to interpret its meanings in a particular context as seen in the following excerpt provided by participants 26 and 28 in the group concurrent protocols.

ST 26 and ST28/ what's so good about the primary terminal and hangar facility // at Spaceport America / so that means // that means / we can fly to space like we are flying around in aeroplanes/ okay (aspirated sigh)

ST 26 & 28= participants number 26 and 28

This strategy was further demonstrated by study participant 40 who tried to connect meaning through domain or background information known.

> …a team of U.S. and British architects and designers / won a recommendation for designing the primary terminal and hangar facility at Spaceport America // structures that symbolize the world's first purpose-built commercial spaceport a team of […] most likely with the help of NASA also- ST 40

Other participants tried to connect meaning through links to known concepts.

> ST 27 (stretches arms sideways to a span of arms) but the space port reminds me of star trek
>
> ST 28 / ha ha / star trek / games
>
> ST 36two carrier aircraft and five Space Ship Two spaceliners — vessels now under construction at Scaled Composites in Mojave, Calif / not sure of the country / not

It appeared that participants ST27, ST28, andST36 were making attempts to determine the understanding of unknown words through mental lexicon linkages.

Context analysis allows L2 learners to make sense of word combinations and possible word meanings. Twenty eight participants (68%) have drawn upon this strategy for comprehension of text and learning meaning showing that it was a well used strategy in this particular category of L2 learners who are tertiary learners with Malay/Chinese L1.

5.3.3 Morphemic Analysis

A morphemic analysis strategy is defined in this study as the ability of learners to be conscious of word meanings and functions. It is about the way in which L2 learners show an understanding and interest in words and how they are used in the text. When using this strategy, L2 learners have an awareness of meaning through

understanding usage of prefixes or suffixes added to root words including inflectional and derivational functions. In general, morphological information is used by L2 learners to obtain an understanding of new words or low frequency words encountered. It is a cognitive strategy as the analysis involves an assessment of the mental processes while vocabulary learning occurs. This is shown through the way in which L2 learners use words because of the way they sound through its phonological attributes. It is also a semantic strategy as it relates to how learners use words according to word meanings.

ST 14 I like for example/this is one word that I did not know to use before/ for example/ decrease/ but ever since I studied Physics and Chemistry/ I use the word decrease and I began to use the word decrease/ almost always// I don't use it everyday/ I use it when [*] just like the word[…] decrease/ yeah

ST 17 yeah some words just as I said […]I really like the words and I start using them. A word for example that I use regularly now is "belligerent" or "obnoxious" just because I really like the words and that's why I use them in my vocabulary. That's about it.

ST 14, ST 17 = student number 14 and 17

Focussing on form is a strategy that encourages learners to learn words and make them part of their productive vocabulary. Perceiving the form of a word while reading or listening and trying to retrieve its meaning relates to morphemic analysis. This vignette shows how L2 learners expressed distinctly that the appearance and morphological characteristics of words supported them in acquiring their meaning and converting them into productive vocabulary when they started using them in speech and writing. These accounts provide for a plausible standard expected pattern of morphological analysis. The vignette by participants ST 15 and ST 18 further illustrate how morphemic analysis is used as a strategy.

ST 15 For me, I would use them if the words are quite easy to remember// and easy in meanings also[...]

ST 18 I will use words I like everyday like maybe in email or SMS (short messaging service)/ or when I talk with my fiends or family

Learners recounted on the usage of words depending on whether they were easy to remember and easily identified through meaning. Using the morphemic analysis strategy, learners appeared to practise categorising and analysing words according to their forms and meanings. They also gave accounts of knowing or learning words according to how it sounded and appeared in written form which makes it a semantic strategy. Twenty fine study participants (61%) of the participants in the study applied this strategy indicating there is high use of this strategy by these L2 learners.

5.3.4 Structural Analysis Strategy

Syntactic or analysis strategy is defined in the study as the ability to integrate new linguistic information into learners' lexical systems. Using this strategy, a higher level of decoding and inferring of meaning occurs and syntactic information is used for text processing. This is recognised in research in reading (Hirsch, 2003). To use a structural analysis strategy, L2 learners require text comprehension skills such as establishing and retrieving connections between new linguistic forms and specific contexts in which they were encountered. Strategic knowledge may be referred to as the category of knowledge that determines vocabulary development from context. Through this strategy L2 learners effectively use context to improve vocabulary. This is a cognitive strategy as the participants actively used learning processes through assumptions, transfer and other strategies.

The following excerpt from the group concurrent verbal protocols gathered from participants show that structural analysis strategy use was evident. The speakers were trying to connect and construct meaning.

-ST 30 and some of the familiar words / I have known in the past / and some of the articles that I've actually known

" [w]hen the 100,000-square foot (9,290-square-meter) facility is completed the structures will serve as the primary (stresses primary)- ST 31 // operating base for Sir Richard Branson's Virgin Galactic sub[…]orbital spaceliner // that may be a spaceship that is in orbit // as well as the headquarters for the New Mexico Spaceport authority /authority[…]hmm[…] so it's like a inter space flight/inter space flight // interesting / ST32 / interesting / okay // the spacious maintenance hangar can hold two white knight two carrier aircraft // two white / two […] quite big- ST 33 // and five space ship two space liners // vessels now under construction at scaled composites in Mojave/ calif // interesting // interesting /okay // something like instead of having an airport // we are having a spaceport to / travel to space/ cool / can travel to space next time -ST 34

ST 31, ST 32, ST33 and ST34= student participants number 31, 32, 33 and 34

ST 26 New Mexico unveils spaceport design // low-lying look will be environmentally friendly // architects say / how can such things be environmentally friendly (questioning tone) ST27- probably it's how environmentally friendly it can be // yeah / how can it be if they use different type of buildings (questioning tone) ST 28
– they're building a space craft / how can it be(questioning tone) ST29 this is construction for the building / building / not the space craft / laughs / laughs / not the space craft ST 30*

ST26,ST27,ST28,ST29,ST30= student participant 26,27,28,29 and 30

In structural analysis the L2 learners attempt to make proficient connections using clues that help them form associations. Even if they do not gain the full meaning or the relationships of the unknown word, they are able to categorise the word in some aspect and gain meaning to develop comprehension. Thirty two participants (78%) of the participants used this strategy, making this the most frequently used strategy among the particular group of students investigated. It was notable in the study that as tertiary learners who had learned English as a second language throughout their school (average of 13 years), the majority of participants used a complex or higher level of decoding and constructing strategy for vocabulary learning.

5.3.5 Repetition and Multiple Exposures

Another strategy used by participants in the study identified through the transcribed protocols is using repetition to advance vocabulary. Multiple exposures to words contributed to L2 learners' understanding of word meaning. Using this strategy, L2 learners seem to learn words through repeated encounters rather than from a single context or encounter and meanings of words were engendered through frequent exposures to unknown words in context. The self-talk and self-encouragement which is seen reflected in this category of L2 learners indicates this is an affective or social learning strategy. However, the manner in which the learner takes note of the new words encountered and the assessing quality of the strategy places this under the category of a meta-cognitive strategy as there is a conscious effort on the part of the learner's intention to be aware of new vocabulary.

ST 14 when I come across the particular words more than a few times /it // will seem to become part of my vocabulary/

ST 19I might try using it in my writing/ after reading the words a couple of times /I will use it in my writing or in my conversations then and it will become part of my own vocabulary/

ST 21I usually have to see and view more examples of these words before it is registered in my memory

ST 22one way is to read widely// if you read a wide variety of books/ magazines and reading materials// you are bound to bump into words you looked up and it would be used in a different sentence /and you get a different angle of it/ in terms of using it// well [*] if you keep writing and using it/ it means sooner or later/ it's going to stick in your mind /and recalling it will also be easier

ST14,ST 19,ST21,ST22= student participants number 14,19,21 and 22

As L2 learners encountered words repeatedly, they attempted to acquire more information about the word until a better understanding of the word was developed. This incremental knowledge seemed to motivate learners to acquire proficiency. The accounts given here indicate that new vocabulary can be attained by L2 learners through frequent reading and through coming into contact with vocabulary

in texts. Vocabulary seems to be acquired gradually from a single exposure to the word to multiple exposures and usage. It is to be noted that simply repeating the word alone would not assist in generating productive vocabulary and attempts must be made to use the new word encountered in their writing and speech. It is possible for learners to retain the new words through repeated usage. This may involve learners consciously creating opportunities for themselves to notice the new words and use them through varied approaches in different contexts, for the new words to become part of their mental lexicon. Verbal protocol analysis indicates that 22 (54%) participants of the learners have used this strategy.

5.3.6 Referring to the dictionary- monolingual or bilingual dictionaries

The strategy of referring to dictionaries, either monolingual or bilingual, is categorised in the study as a semantic strategy as it is related to learning word meanings. In using this cognitive strategy, learners refer to dictionaries to find meanings of words perceived as difficult, or to find synonyms of words. They may refer to the dictionary to look for examples of word usage. Another notable variation of the dictionary references accounted for in the present study are the references made by participants to search engines to look for meanings, as a new strategy. Overall, 30 study participants (75%) participants referred to dictionaries as a vocabulary learning strategy making this strategy one of the most frequently used one.

The excerpts given below show ways in which learners have used the dictionary learning/ referring strategy.

> ST- 30-I will refer my / suborbital and space liner in the dictionary to know more about what they meant by that /well/ I think I will refer to these terms ST 29/ I'll start googling / and find out pre flight / and post flight
>
> and / yeah / some of the terms that I don't know / I'll definitely check them out in the dictionary -ST 32

ST 33- okay / I will go and research about Sir Richard Branson and read about / some of his work / to better understand

ST- 34 like in Mojave / California / it seems to be quite interesting / lots of words and all that which I'm not familiar with / which I will look up in google or the dictionary / and find out info about this / article-

I think I will find out what this article is talking about / through the internet and[…]- ST36.

ST-37 like in Mojave / California / it seems to be quite interesting / lots of words and all that which I'm not familiar with / which I will look up in google or the dictionary / and find out info about this / article-

ST29, ST30, ST31,ST 32, ST33, ST34,ST37 = participants number 29,30,31,32,33,34 and 37

The data indicate that dictionary referral strategies were used in conjunction with other strategies to gain a more holistic knowledge of text. The propensity for turning to internet resources for meaning construction and for plausible comprehension solutions also gave a sense of technology dependency on the part of L2 learners in this study.

5.3.7 Peer learning/ Social Constructivist Learning

Peer learning is categorised here as a social learning strategy and is defined in this study as a strategy where learners consult more knowledgeable learners to affirm meanings of new words encountered in text. This is a social learning strategy as the L2 learners collaborate or interact with others including peers or instructors to check for meaning or guessing word meanings. This strategy seems to be prevalent in a social constructivist learning environment where social learning is encouraged. Using this strategy, L2 learners seek clarification from their peers or teachers or seemingly more scholarly individuals present in their social realm of learning, for text comprehension.

ST5Firstly, I usually read the sentence// but if I don't understand the whole paragraph[…] if I don't understand// I'll look up in the dictionary and/ if I still don't understand or/ if I

don't have a dictionary with me at that time// I usually ask my friends around me who could help me out with the words

ST9When I read articles and I come across some difficult words// well/ I read it over a few times and try to guess the meaning from the sentences and //if I really don't understand, I'll move on[…] occasionally/ if possible, I'll see someone close by and just ask them.

ST12When I read articles and come across difficult words I will either ignore the words// or ask my friends what the meaning of the words are / I will use new words// when my friends use that particular word in our daily conversations

ST5,ST9,ST12=participants5, 9,12

Peer learning is a self-created opportunity for learning new words and could be used both inside and outside traditional classrooms. In that respect, peer learning strategy permits continued learning of vocabulary outside traditional learning spheres such as language labs or classrooms. Seventeen participants (41%) reported using this in self-reports or retrospective protocols gathered in the study which lends support to the notion that that these tertiary L2 learners developed understanding of word meaning through social constructivist settings.

5.3.8 English for Specific Use

In the study, L2 learners using English for specific use strategy, attempted to connect words to specific contexts or disciplines. Prior knowledge of the discipline or domain acquainted the student with the specific words that appeared in contexts related to their discipline of learning. This strategy requires learners to have a good knowledge of the discipline area as well as English language proficiency as it entails them to use vocabulary and structures that they have previously learned in meaningful contexts. Here the L2 learners approach the study of English vocabulary through a field that is already known and applicable to them. Being tertiary learners at university, the L2 learners have opportunities for encountering terminologies in engineering related domains. In the following excerpt the participants deliberated over

specific vocabulary related to 'space' and 'environment' to ascertain meaning of the text they were reading and indicated that they would focus attention to words if they were linked to their study.

Alright / New Mexico unveils / spaceport design. I will actually try to find out what spaceport means ST26 but because it's written by Leonard David / special correspondent from space.com / I would assume it's something / to do with / space ST 28 (raised tone) / or anything to do with exploration of space ST 28 / (reads inaudibly) taking the wraps off / new images/
ST 40 -New Mexico unveils spaceport design // low-lying look will be environmentally friendly // architects say….how can it be environmentally friendly//[…] probably it's how environmentally friendly it can be// they don't use asbestos / they don't use PVC / they use steel and glass/ maybe […]steel is said to be environmental friendly I think

ST 26, ST 40= participants number 26 and 40

ST 10…Frankly speaking I don't use new words unless they are relative to my studies. (English for specific use)

ST10=participant number 10

L2 learners using English for Specific Use strategy focussed on the expressions, especially on lexis appearing in context to construct and acquire meaning. This is similar to encoding in a specific discipline and can therefore be categorised as a memory strategy. Encoding strategies encompass semantic and contextual encoding in context. Fourteen participants (34%) demonstrated through protocols that they used this strategy for learning how to use words. This indicates that productive vocabulary could be gained through using English in specific disciplines.

5.3.9 Limited Processing Capacity

In this thesis limited processing strategy is defined as a strategy used by learners when they experience a lack of connectivity to the new words encountered. It

is presumed that if inferencing is not assisted by contextual clues or prior background knowledge L2 learners are inclined to stop constructing meaning. By using limited processing strategy the L2 learner shows a conscious awareness that the new word is difficult to comprehend. This is a meta-cognitive strategy since it involves analysing the text or specific words come across in the text.

> ST 13 -I only use the words if I like the word (laugh) […] and if it' very difficult/ if it's very long // many syllables // I probably won't use it.
> ST 4 When I read articles and come across difficult words[*] I will either ignore the words… or // I'll read it a few times..

ST 4, ST 13= participants number 4 and 13

Participants ST4 and ST13 provided accounts on strategies of paying attention or ignoring difficult words. The fact that they have identified these words as 'difficult' or not known to them indicates they have noticed them and this needs to be recognised as a learning strategy. This strategy is linked to the lexical density of a text when the occurrence of low frequency words appears to deter comprehension of the text. Further reports by study participants from group concurrent protocols demonstrate usage of this strategy as shown in the following illustration.

> Selected from an international field of 11 firms, the winning design is the work of
> URS Corp/ what's URS – ST27 […]a large design and engineering enterprise,
> teamed with Foster / okay/ don't know what they are- ST29*
> ST 39The spacious maintenance hangar can hold two white knight// I don't know what's that // they are

ST 27, ST 29, ST 39 = participants number 27, 29 and 39 respectively

In summary, L2 learners using limited processing capacity hold on to the perception that words that are longer or contain many syllables are harder to remember, or more difficult to convert to productive vocabulary. In this framework, limited processing capacity is defined as an inability for text processing. Using this

strategy L2 learners are made aware of lack of word meaning and may be able to take active measures for the next course of action for text comprehension. Eight participants (20%) in the study are known to have applied this strategy for text comprehension.

5.3.10- Retaining New Words Depending on 'Need'

Using this strategy, vocabulary is learned through self-initiated needs of the learner, or through strategies activated through the motivation of the learner, where the learner retains new words depending on 'need'. This is a meta-cognitive strategy, where the learner makes a decision to learn new words encountered because they are motivated to learn for achieving their 'needs'. In the following excerpt from self-report protocol analysis, participant ST 7 showed a sense of determination to learn new words through several related strategies such as referring to dictionaries, guessing and learning synonyms primarily as a motivation or challenge to learning.

> ST 7 the first thing I do after I read the sentence is if I don't understand the word I
> try to guess the meaning and I challenge myself by looking it up in the
> dictionary[…]rather I like to look for synonyms to see if I know more vocabulary by
> searching words[*] if I know the synonyms of the words// So, if I guess it right/ it's
> a kind of challenge to my own self//

ST7= participant number 7

Determining meaning of new words and acquiring them through various strategies signify an inherent 'need' in the learner. It indicates that strong motivation is applied to learn the meaning of a word when first encountered as well to consolidate meaning of the word through learning synonyms in order to ascertain that the strategies used are effective.

> ST 9 Once I do understand the words// I'll try to incorporate them into my writing// [*]
> and sometimes I do combine them if necessary and do apply/ them once I learn them

ST9= participant number 9

The tone used by participants ST7 and ST9 denote a sense of determination and desire to learn and make words encountered in context part of their mental lexicon. The participants' focus was on accepting strategies that were required for vocabulary learning. It reflected a need to engage themselves in methods of learning new words.

It is encouraging to note that 11 participants (27%) in the study demonstrated that they were motivated to retain new words through a 'need' strategy.

5.3.11 Retaining New Words Depending on 'Search'

Retaining new words depending on 'search' is defined in this thesis as a strategy through which L2 learners attempt to learn or acquire new vocabulary through activating reading skills, or learn new vocabulary through 'search' strategies. This is a meta-cognitive strategy as it involves contemplating on learning processes such as planning on how to learn new words or actively using media such as newspapers, magazines, TV or the internet to learn new words. Participants using the retaining new words depending on 'search' strategy, used news media, both print and electronic as resources to acquire new vocabulary. L2 learners also appear to employ higher order learning skills as they have made their own decisions for learning vocabulary.

> ST 20-In order to retain new words or use them as part of my vocabulary//usually I
> just try to read new words from newspapers or magazines[...]sometimes I get new
> words from TV shows and refer them to the dictionary
> ST 22- to learn new words //I would try to read more books and communicate with
> people who are good in English[*]

ST 20, ST22= participant number 20 and 22

> ST 16- Basically to retain new words I would read magazines, //listen to news/

The participants who showed an inclination towards retaining new words depending on 'search' alluded to specifically using resources that assisted them such as internet search engines like 'google'. As reported by participant number 30 on the strategy used to find out meaning and acquire it.

> I will actually find out what this word means through 'google' and learn it
> ST34- some of the familiar words I have known from the past/ from the articles I
> have read/ also from the computer / or from googling also from the computer/ / I
> will retain them/

"I will google this" was repeatedly stated by at least 34% of participants. This points to the tendency of some L2 learners to use search engines like google to access meanings. Very few participants referred directly to using the internet or multi-media as a learning strategy, however, they specifically mentioned 'google', once again supporting that the L2 learners used new vocabulary retrieval resources.

The excerpt indicates the determination to use multimedia resources to learn new words. Ten participants (24%) of the study participants demonstrated they used this strategy indicating the rising trend on technology dependency for vocabulary needs of L2 learners.

5.3.12 Retaining New Words Depending on 'Evaluation"

Retaining new words through evaluative strategies is defined in this study as a cognitive strategy as it demonstrates the mental processes involved while making decisions to learn new words. It shows how the learner directly manipulates or transforms the learning skill or material. It involves a recording strategy that helps the learner to process the word. It was also observed that learners who used this strategy

often made a decision about the semantic and formal suitability of the word and its context. It is also noticed that learners who use this strategy often make a decision about the semantic and formal fit of the word and its context as reported by other vocabulary researchers such as Pulido (2007).

> ST 13- […]I like for example// this is one word that I did not know to use before, for eg. 'decrease' //but ever since I studied Physics and Chemistry /I wrote it down and I use the word 'decrease' and I began to use the word 'decrease' //almost always[*] I don't use it everyday. I use it when […] I just like the word decrease, yeah.
>
> ST 18I think I do use them in my own writing, but it depends on what type of things that I writing too.
>
> ST21- I'm a Cantonese speaker but I can use English better in my writing and my speech if// okay I write the new words down // and then I use them more often in my speech

ST 13, ST 18, ST 22= participants number 13, 18 and 21

The above excerpts suggest that L2 learners have made decisions to learn new words based on evaluative judgement. Participants made assessments of the linguistic qualities of the words before making decisions to learn them or retain them. Writing down the new words learned or making note of them is a cognitive activity.

> ST 11-I don't have strategies to retain new words. I usually leave out new words in my writing unless those new vocabulary is necessary for my writing.

ST11= participant number 11

Participant ST11 had made a decision to learn new vocabulary if there was a need to incorporate them in writing. This can be considered as a generative strategy or productive strategy as it shows that techniques such as writing down new words motivate learners to achieve retention of words. Nine participants (22%) were noted to have used this strategy in the study.

5.3.13 Guessing Meaning of Unknown Words

Through guessing L2 learners often tried and used cognitive strategies to gain vocabulary knowledge of the target language or L2 to be acquired. In this study this strategy is representative of L2 learners who use guessing strategies to interpret background knowledge or use linguistic clues to guess the meaning of new words in the texts. In this strategy learners depend on the context such as background, sentence structure, grammatical knowledge etc to infer meaning. This is essentially a cognitive strategy as it necessitates mental processing and planning and management of materials is necessary. The rationalisation for relating guessing strategy to L2 reading came from cognitive science models of reading and schema theory (Dycus, 1997).

> ST1I will read the whole sentence, where the word is in the sentence and then I'll try to understand the meaning in the context of the sentence

> ST2 I like reading a lot and whenever I come across new words like .. the first thing I do is try to understand it from the sentence itself. I read it over and over again and try to figure out the meaning

> ST 8Well, when I come across difficult words, I would usually try to guess their/ its meaning by looking at the sentence structure

ST 1, ST2,ST8= participants number 1, 2and 8

Research shows that this is one of the most used and significant strategies for vocabulary learning (Gu & Johnson, 1996). Using context to guess word meanings helps readers build vocabulary (Nation, 2001). Guessing meaning of words strategy is developed in L2 learners who like reading and have some advanced skills in interpreting meaning from context as expressed by participant ST11*. The excerpts from participants indicate that using context to guess word meanings helps them build vocabulary because they are more likely to remember words. Guessing from context has advantages of encouraging reading enjoyment and improving comprehension because readers do not have to interrupt themselves frequently to use dictionaries (Mikulecky & Jeffries, 1996). Most of the participants who mentioned using this

strategy stated that they also verified the meaning deduced by referring to the meaning in a dictionary.

> ST 11-I will guess the meaning first by looking at the sentence structure and if it is necessary I will refer to the dictionary.

ST11= participant 11

> ST17If the meaning that I guess coincides with the dictionary meaning or is close enough, that reinforces the words inside my head and I remember the meaning.

ST17= participant number 17

> ST 35*the primary terminal and hangar / hangar is giving me a rough idea of an airport ST 12 (questioning tone) facility

ST35= participant number 35

The protocol analysis show that L2 learners are motivated to continue reading and learning new words if the guessing strategy confirms accuracy of meaning. L2 learners who used the strategy of guessing and verifying accuracy of meaning specify they have taken a structured approach to their learning. 23 participants (56%) indicated in retrospective verbal protocol that they used this strategy to retain and learn new words.

5.3.14 Expressing Lack of Understanding

In the study a new strategy was noticed in which the L2 learner expresses a lack of understanding. This strategy is a meta-cognitive strategy as in this strategy the learner is considering and assessing learning. Noticing new words and active

processes of learning are known strategies in vocabulary learning (Nation, 2001.) However, expressing lack of understanding has not been reported in previous studies.

Participants ST 29, ST 40 and ST 41 demonstrate in group concurrent verbal protocol analysis that they did not understand parts of the texts they read.

ST 29…and lounges. The spacious maintenance hangar can hold two white knight// I don't know what's that // they are
ST 40 questioning tone) at the futuristic facility // a team of U.S. and British architects and designers won a recommendation for designing the primary terminal and hangar // hanging or what / I'm not sure

ST 29,ST40 = participants 29 and 40

ST 41Selected from an international field of 11 firms, the winning design is the work of URS Corp/ a large design and engineering enterprise, teamed with Foster / hm..// never heard of them/

ST41= study participant number 41

This strategy may raise an awareness in L2 learners about that the fact there is a gap in their comprehension and may prompt them to learn the new words. However more research is necessary to establish how this strategy works for developing new vocabulary. Twenty participants (48%) referred to not knowing part of texts or expressed lack of understanding of text meanings in the concurrent protocols gathered during the reading task activity. This knowledge is useful as the present thesis believes that L2 learners who are able to express awareness or lack of knowledge can be engaged in appropriate ways through explicit teaching of vocabulary strategies.

5.3.15 Visualising

In this study, visualising is defined as a strategy through which L2 learners develop a sense of imagination about words or connect to the text through the formation of mental images. It is believed to be a memory strategy as it is kind of

encoding strategy. Previous research mentions this strategy as part of encoding (Ghazal, 2007), but none offer empirical evidence and therefore it is notable that this strategy was identified in the study. Excerpts from the group concurrent verbal protocols show that learners imagine or visualise the context to determine meaning. This strategy is assumed to be used by L2 learners with higher L2 language proficiency as it requires an ability to connect to terms/ phrases/ words from the context accurately.

ST27-New Mexico unveils spaceport design….. is there a picture- (questioning tone)

ST28 as well as the headquarters for the New Mexico Spaceport Authority (Reads the next lines, 5 and 6 beneath the breath) the space craft /hm /space liners// can't imagine them//

ST28primary terminal and hangar facility at Spaceport America // structures that symbolize the world's first purpose-built commercial spaceport/taking the image

ST34the futuristic facility / have they built yet or just designed- sprawling / how do you visualise it (questioning note)

ST27,ST 28,ST34= participants number 27,28 and 34

Visualising is assumed to function through mental imagery through connections with prior background knowledge or through formation of images in the mental lexicon to develop linguistic associations. Further research is required to analyse accurately how this strategy develops L2 vocabulary. Thirteen participants (32%) have demonstrated use of this strategy in the study. Additional research is needed to assess the strengths or efficacy of this strategy as well as to determine ways in which this strategy develops L2 vocabulary.

5.3.16 Transfer Process

Transfer process is defined as a strategy in which the L2 learners in the study preferred to translate the L2 text into their own L1 to infer meaning or check for L1 cognates. This is categorised here as a memory strategy as this strategy requires encoding skills and a well developed L1. Further, using transfer strategy required the L2 learners in

the study to have active plans and therefore this strategy could be considered as a cognitive strategy. In general, most participants like ST1* and ST13* in the study reported in retrospective verbal protocols that they translated into L1 for better understanding of the L2 text and words encountered. The participants did not specifically mention if they used specific resources like bilingual dictionaries, or how they handled ambiguities in the text when they used transfer or translation strategies in text comprehension.

ST1If I write the essay, I'll think in Malay first and then I'll translate into English and write it

ST1=participant number 1

ST13 To be honest I translate because I'm actually better in my Malay language but in English I'm not good// /I'm better in writing English than Malay/ but when it comes to talking I'm better in Malay than English[…] because /English has this past tense thing// which is confusing// between them//in Malay you can just speak however and whatever you want and people still understand you, whereas English.. I don't know I feel like/ I have to talk proper English/ and I always jumble my words up

ST13=participant number 13

Ten participants (24%) were noted to have used translating or transfer processes strategy for text comprehension. Further studies on how this strategy is used by L2 learners are required to understand transfer processes better.

5.4 Summary of Strategies

An interplay of various lexical entries and inferencing strategies and transfer strategies in the meta-cognitive schemata, seemed to assist in L2 vocabulary production processes in the mental lexicons of the participants in the study. It is presumed that active vocabulary strategy users are more likely to be more effectual vocabulary learners. From the retrospective and concurrent verbal protocol analysis, several inferencing and vocabulary learning strategies were noted to be used by the participants. Four strategies were used most, which are: structural analysis, dictionary

reference, context analysis and morphemic analysis. Four new strategies or variants of strategies were used by participants which are: registering satisfaction with assimilation, referring to internet search engines like 'google', expressing lack of understanding and visualising. Participants used multiple strategies simultaneously to assist them in reading comprehension and for L2 vocabulary development. Table 5.2 summarises the number of strategies used and the percentage of participants who used them.

Table 5.2 shows the percentage of users in the study for each strategy identified

Table 5.2 Vocabulary Learning Strategies Identified in the Study

No	Vocabulary Learning Strategies	Percent
1	Text Processing	51
2	Context Analysis	68
3	Morphemic Analysis	61
4	Structural Analysis	78
5	Repetition and Multiple Exposures	54
6	Dictionary Reference	73
7	Peer Learning/ Constructivist Learning	41
8	English For Specific Use	34
9	Limited Processing Capacity	20
10	Retaining New Words depending on 'need'	27
11	Retaining New Words depending on 'search'	24
12	Retaining New Words depending on' evaluation'	22
13	Guessing Meaning of Unknown Words	56
14	Expressing lack of Understanding	48
15	Visualising	32
16	Transfer Processes	24

5.5 Conceptual Theoretical L2 Model of Vocabulary Learning- Objective Two

This section provides an overview of the conceptual L2 vocabulary model developed subsequent to the analysis of vocabulary inferencing strategies from the first phase of the studies. It attempts to provide a description of the continuum for the

patterns of vocabulary inferencing processes occurring from pre-receptive to productive stages of vocabulary development.

The conceptual model underscores the constructs of the social learning environment in which the L2 learners develop their vocabulary proficiency as well as the contexts of the pre-receptive- productive vocabulary learning (PR-PV). From the verbal protocol analysis, it is indicative that during reading, L2 learners simultaneously used various meta-cognitive, cognitive, memory and social strategies for vocabulary learning. The conceptual model begins at the pre-receptive (PR) status of the L2 learners where it is assumed they have a well established L1 language schema with developed syntax and lexeme knowledge. L2 learners in the study are believed to have experiential and sensory knowledge equivalents and prior knowledge of the L2 (English) as they have studied English for 13-14 years as a second language and are currently at a tertiary level of engagement with the language. The study indicates that L2 vocabulary learning is a process of constructing meaningful representations, of making sense of one's experiential world. The model has dimensions of learning embedded in it to describe the processes occurring, when an L2 learner encounters new words for the first time during reading.

It is presumed that there is some cognitive conflict occurring when learners encounter new words at receptive vocabulary process and as described by the study participants they endeavour to find some matches to their L1 schema. This notion has similarities to elements in Piaget's theory that when a learner encounters knowledge that is not in agreement with constructed knowledge of the world, then the learner attempts to process it into a rational scheme. In the model when the learner is successful, the knowledge is integrated but if it conflicts with pre-existing schema, the learner attempts various strategies for assimilation of new knowledge as evidenced in the verbal protocol analysis of the inferencing strategies. The new word encountered is categorised into the various levels of lexical entries as in semantic, syntactic, morphological and formal entries. Based on the lexical entry in the mental lexicon, the learner identifies corresponding strategies for inferencing. During inferencing using contextual clues, the L2 learner needs to account for the lexical density of the text. The notion of lexical density has not been accounted for in models of L2 vocabulary learning. The various strategies such as memory, meta-cognitive, cognitive and social

strategies employed have been based on the learners' pre-receptive vocabulary (PR) proficiency.

The conceptual model assumes that there is an interaction within the strategies employed by study participants depending on the nature of the text encountered. Both word knowledge and background/domain knowledge contribute to the nature of strategy/strategies employed. Prior knowledge or PR vocabulary proficiency allows the learners to make quick matches with L1 and L2 schema which aids in text construction or comprehension. Multiple connections are assumed to be made with the assistance of the strategies employed. The study believes in instructional mediation to enhance efficacy of the pre-receptive- productive (PR-PV) process. This perception is also echoed in the retrospective self–reports provided by some study participants.

Reading widely is perceived as another effective method to retain new vocabulary and convert them into productive vocabulary as stated by one study participant.

"…one way is to read widely// if you read a wide variety of books/ magazines

and reading materials [*] you are bound to bump into words you looked up//

and it would be used in a different sentence /and you get a different angle of it

in terms of using it[…] well// if you keep writing and using it/ it means sooner

or later/ it's going to stick in your mind and recalling it will also be easier".

The L2 learner accumulates word knowledge based on frequency of encountering the words and the regularity of usage of the words in both, written and spoken language, or productive vocabulary (PV). This knowledge provides impetus to providing learners with opportunities for experiencing vocabulary through explicit teaching or activities that raise awareness of using effective inferencing strategies. The vocabulary to be learned is to be presented in a specific domain. More opportunities for productive vocabulary transpire when the domain is familiar to the reader which

entails facilitated or mediated instruction. While vocabulary research recommends extensive reading for incidental vocabulary learning, the rationale for explicit teaching of vocabulary strategies require more empirical evidence. Therefore the present study has attempted to validate the conceptual model of L2 vocabulary development through the second phase of the study which involves experimental and control groups. The validation for instructional mediation and the conceptual L2 vocabulary model will be reported in the next chapter.

Figure 5.2-Conceptual Pre-Receptive (PR) - Productive (PV) Vocabulary Development Model

Cognitive Conflict

Learner Processes

Selecting Lexical Strategies – semantic, syntactic, morphological & formal-implicative & explicative

Instructional Mediation

Productive Vocabulary

Production Processes in Mental Lexicon

Meta-Cognitive Schemata

Transfer Strategies

Inferencing Contextual clues

Lexical Density not accounted for in models

Lexical Entries (semantic, syntactic, morphological & formal)

Receptive Vocabulary

Lexical Positioning

Lexical Strategies

- L2 matches
- no L2 match
- L2- complex
- No corresponding Recognition

Pre- Receptive Vocabulary

Prior Knowledge

Prior Knowledge

- Experiential
- Sensory

Established L1 Schema

● Language Schema
● Lexeme, syntax etc.

5.6 Summary of Chapter

The chapter has discussed the findings relevant to the first phase of the study which investigated the patterns of inferencing strategies and has provided descriptions of the various strategies identified. The chapter has summarised and categorised the inferencing strategies employed by study participants and elucidated the extent of usage of the strategies. It has provided a rationale for the conceptual L2 vocabulary model developed. In particular, through the discussion of vocabulary learning strategies, this chapter underscores the significance of the active roles L2 learners require for their own vocabulary development process and emphasises contextual learning of vocabulary.

The next chapter will discuss the findings of the second phase of the study that validate the theoretical model of L2 vocabulary developed and propose explicit instructional mediation of the vocabulary strategies discussed in this chapter.

Chapter-6 Findings and Discussion for Research Objective Three

This chapter presents the findings and discussions pertaining to research objective three and phase two of the study. The chapter reports on the results of teaching interventions focussing on vocabulary inferencing strategies identified from the first phase of the study. The instructional mediational approaches used were identified through the conceptual theoretical L2 vocabulary model (developed in the study). The rationale for confirmation of the L2 vocabulary model is discussed. The chapter then presents the current findings in relation to identified vocabulary learning constructs. The chapter then summarises the discussions on the incorporation of vocabulary teaching and learning activities applied through a constructivist approach in experimental groups of study participants. The pedagogical implications arising from the findings of the study will be reserved for the concluding chapter of this thesis.

6.1 Results of Phase Two of Study

The study aimed at investigating if any vocabulary increments were achieved via the explicit teaching of the vocabulary inferencing strategies in comparative groups of study participants. The results seem to indicate that the experimental study participants who received explicit instructional mediations in vocabulary learning achieved significantly better vocabulary gain scores in the criterion referenced achievement tests than the control group study participants who did not receive any explicit vocabulary teaching interventions but had received standard instructions. The instructional mediational approaches appear to facilitate L2 learners to be aware of the various vocabulary learning strategies for learning productive vocabulary. The correlation coefficient in the test-retest scores showed +1.0 for all groups in the pre-tests indicating that the participants' relative test performance on the two sets of pre-tests were similar. The correlation coefficients in the test-retest scores showed +.8 to +1 in the sets of post-tests indicating that the study participants' test performance was similar. A minimum coefficient reliability of +.7 was set for the study to establish internal stability for

the test-retest methods used for administering pre-tests and post-tests in the study and this was successfully achieved in the test-re-tests in both pre-tests and post tests.

Table 6.1 shows the differences in CRT-pre vocabulary tests conducted in groups C, E and B and F.

Table 6.1 Scores for Pre-Tests

Groups	Tests	Mean	Median	Mode	Co-efficient of Reliability	Standard Deviation
C	1 & 2	17.5	18	18	1	1.785611
C	3 & 4	16.9	17.5	18		1.434563
E	1 & 2	17.8	19	19	1	3.785653
E	3 & 4	15.3	15.5	16		2.293884
B	1 & 2	17.4	18	18	1	3.428869
B	3 & 4	16.7	18	18		2.527939
F	1 & 2	19.1	15.4	19	1	2.786769
F	3 & 4	19	16	12		2.646856

Table 6.2 shows the differences in CRT- post vocabulary tests conducted in groups C, E and B and F.

Table 6.2 Scores for Post-Tests

Groups	Tests	Mean	Median	Mode	Co-efficient of Reliability	Standard Deviation
C	1 & 2	21.3	22	23	1	2.119612
C	3 & 4	18.4	19	19		0.779028
E	1 & 2	22	23	23	0.820324	1.973855
E	3 & 4	18.4	18.5	18		1.007547
B	1 & 2	20.8	21	19	1	2.627787
B	3 & 4	16.75	17	17		2.587645
F	1 & 2	18.6	19	18	1	3.369974
F	3 & 4	14.8	15	12		2.587645

In the Pre-test scores, the positive correlation coefficient achieved is +1 for all tests which show that the tests have fairly high validity and reliability. In the post-tests, test-retest reliability showed that the results yielded similar results with correlation coefficient scores of .82 to +1 indicating stability reliability or consistency. Validity refers to the extent to which the inferences made from a test are justified and accurate and the more comparable the scores are on two or more tests, the more reliable the test scores are (Wells & Wollack, 2003). It is also to be noted that the post-tests were administered after a 12 week interval to measure if there was any difference in the achievement of vocabulary between the control groups that did not receive any explicit vocabulary teaching interventions and the experimental groups that had received the teaching interventions.

The data shows that there is a notable increase in vocabulary proficiency scores by the experimental groups C and E as compared to scores attained by standard groups B and F. The incremental gains seem to indicate that that explicit teaching of vocabulary strategies are effective and also appear to validate the conceptual theoretical L2 vocabulary model developed during the study.

6.2 Results of Criterion-Referenced Pre-Tests

The next section presents particulars of the pre-test scores for the experimental and control groups.

The figures 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7and 6.8, show the frequency and scores in Pre-test results in groups C, E, B and F for Tests 1 and 2 and tests 3 and 4.

Figure 6.1- Pre-test Scores for Group C (Tests 1 &2)
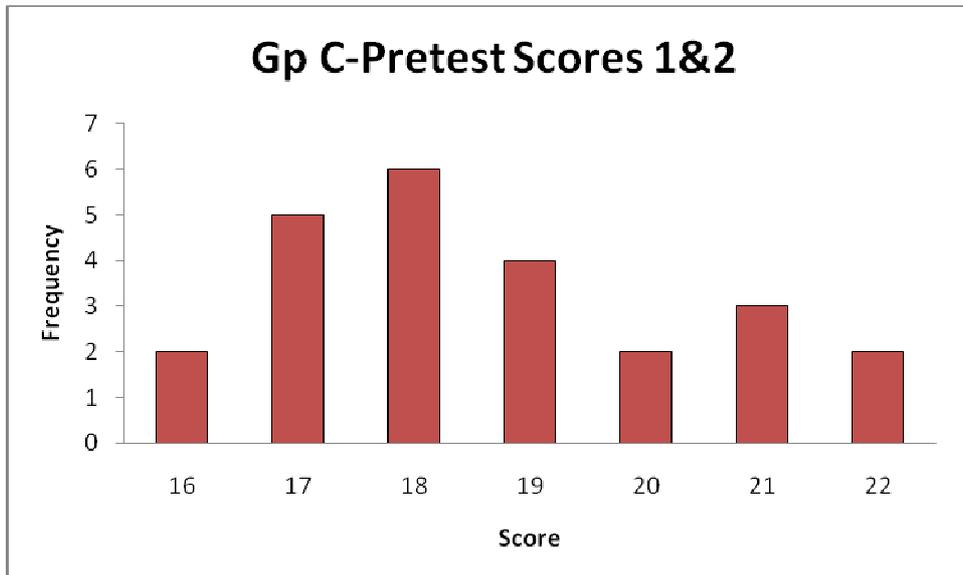
Figure 6.2- Pre-test Scores for Group C (Tests 3&4)
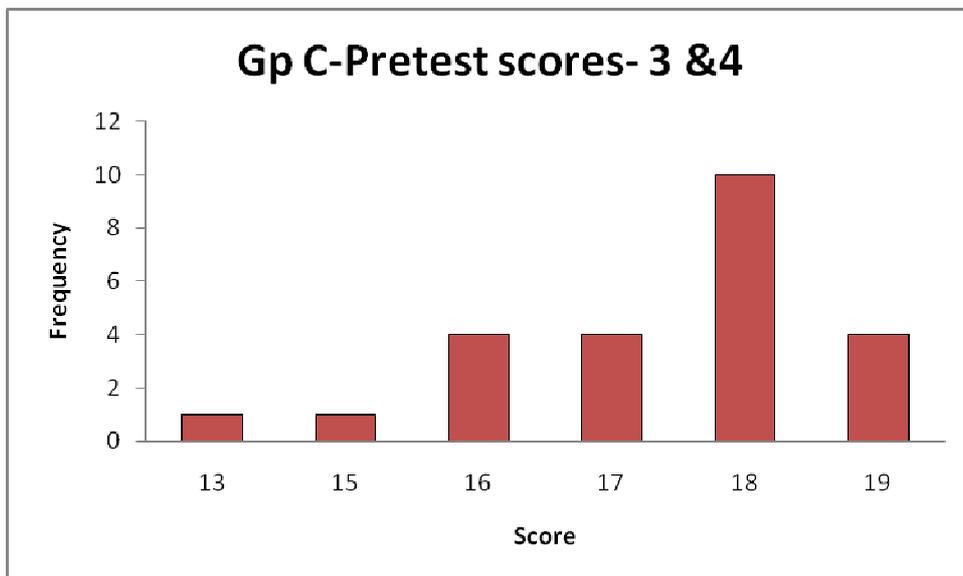
The Pre-test results for Tests 1 and 2 and 3 and 4 in experimental group C show that the mean values attained by the participants were 17.5 and 16.9 respectively and that the

coefficient reliability was+ 1 using the split half method, indicating reliable results. As the pre-tests 1 and 2 were different from pre-tests 3and 4 and the scores were consistent, the tests demonstrate consistency of results for alternate form.

Figure 6.3- Pre-Test Scores for Group E (Test 1 & 2)
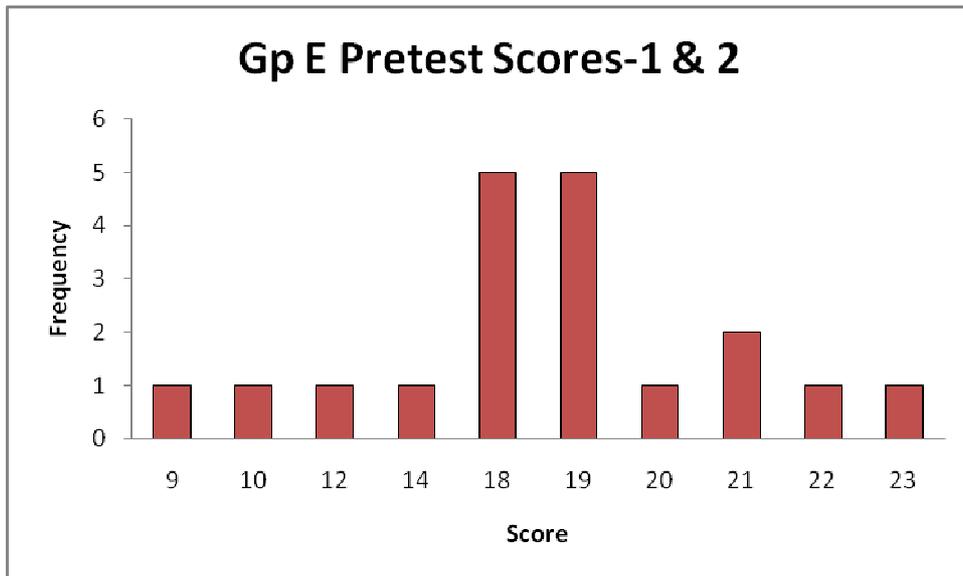
Figure 6.4- Pre-test Scores for Group E (Test 3 &4)
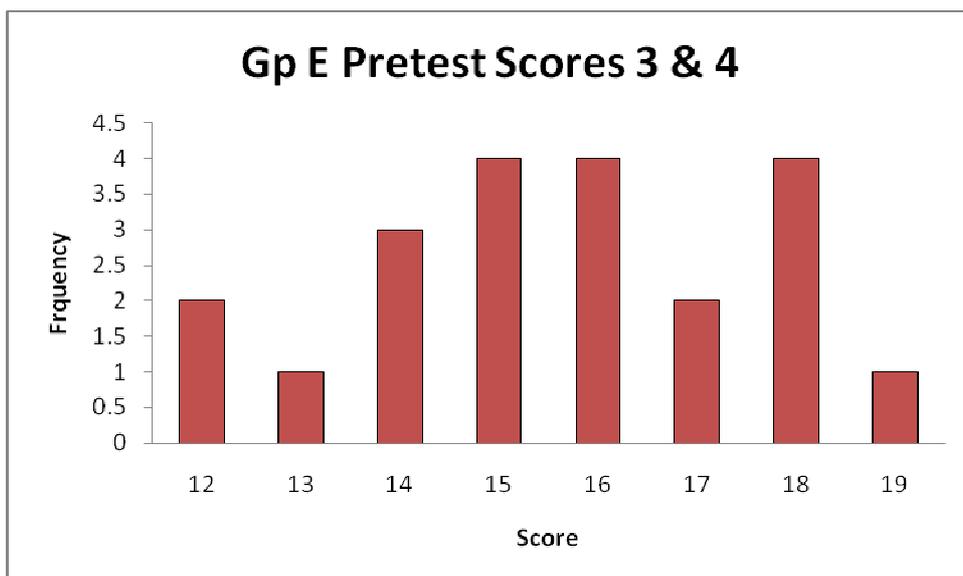
The Pre-tests results for tests 1 and 2 and 3 and 4 for experimental Group E show that the mean values were 17.8 and 15.3 respectively, and that the coefficient reliability was+ 1 showing reliable results as consistency of scores by study participants on alternate forms of tests.

Figure 6.5- Pre-test Scores for Group B (Tests 1 and 2)
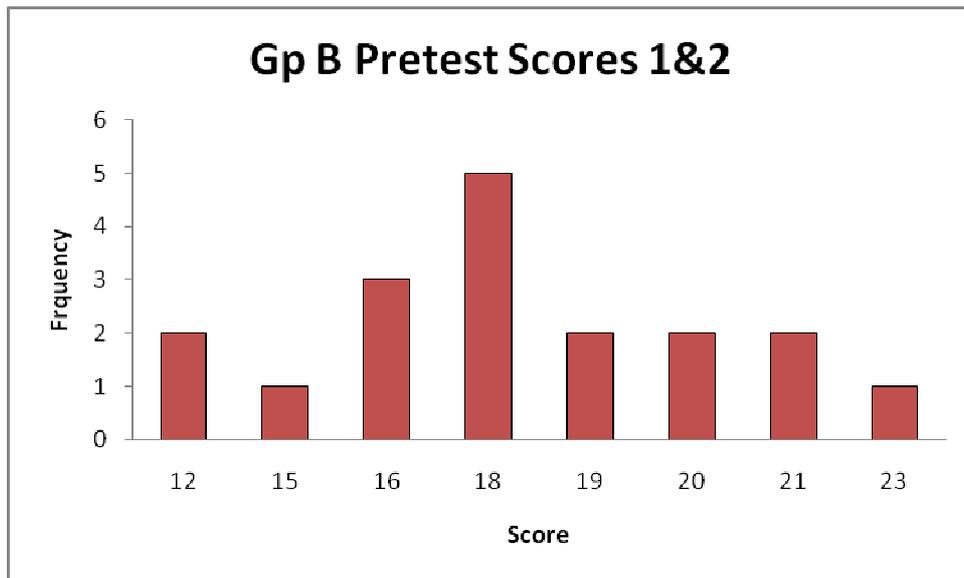
Figure 6.6- Pre-Test Scores for Group B (Tests 3 and 4)
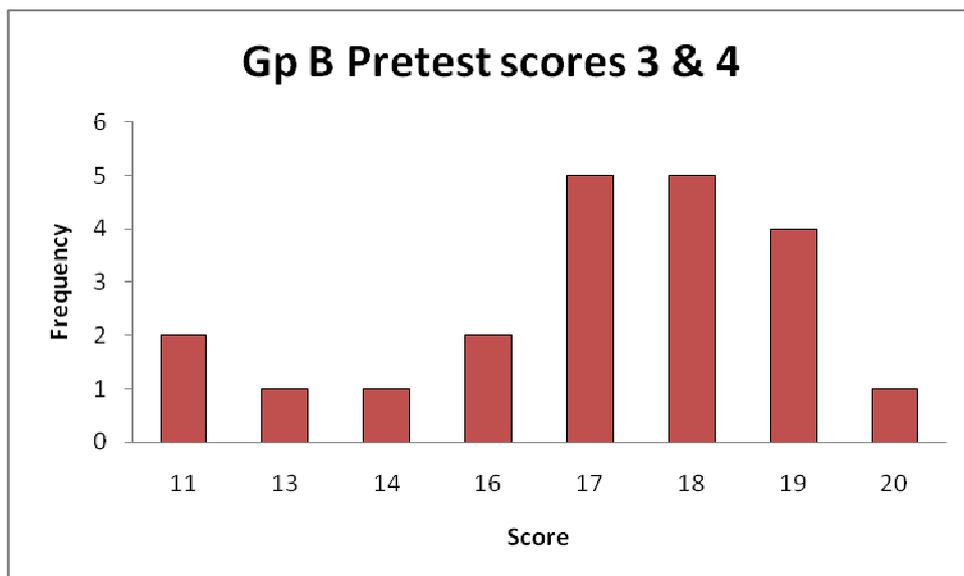
The Pre-tests results for tests 1 and 2 and 3 and 4 for control Group B show that the mean values were 17.4 and 16.7 respectively and that the coefficient reliability was +1 using the split half method indicating reliable results and that there is a positive correlation between the variables.

Figure 6.7- Pre-test Scores for Group F (Tests 1 and 2)
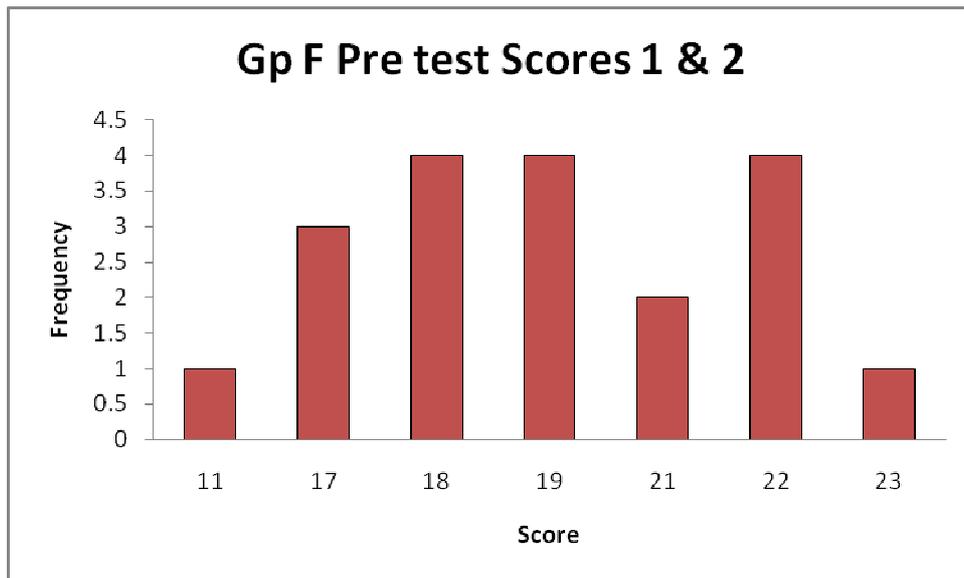
Figure 6.8 Pre-Test Scores for Group F (Test 3 and 4)
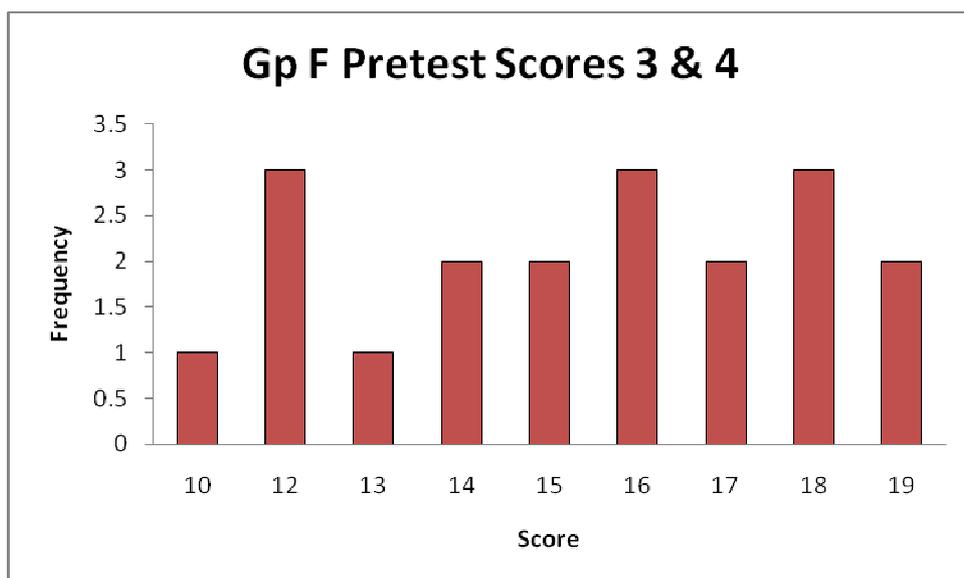
The Pre-tests results for tests 1 and 2 and 3 and 4 for standard Group F show that the mean values were 19.1 and 19 indicating consistency between the scores. The coefficient reliability was +1 using the split half method demonstrating reliable results and positive correlation of variables.

The Pre-tests for all four groups showed a high consistency and alternate form consistency as tests 1and 2 were administered a week earlier than tests 3 and 4. It also demonstrates test-retest reliability as the tests 1and 2, and 3 and 4 are similar in content but administered at different times and study participants attained similar scores. It is also to be noted that for the pre-tests in all groups, the ratio of true score variance to obtained score variance achieved a reliability index of +1 indicating that there is relatively little error and thus confirming high reliability of the pre-tests.

6.3 Summary of Results for Items in Pre-Tests

The CRT-diagnostic pre-tests measured contextualised lexical meanings for receptive and productive vocabulary knowledge, and vocabulary depth knowledge. The pre-tests attempted to attain comprehensive vocabulary skill profiling of the test participants. The identical four CRT-diagnostic pre-tests measured how participants scored on items selected from reading contexts based on four technical/engineering related articles. The participants demonstrated their vocabulary proficiency through a total number of 53 content words selected from context. The vocabulary skills measured through the items in the pre-tests illustrated recognition skills, lexical knowledge, depth of vocabulary knowledge, knowing meanings in different contexts, and technical vocabulary skills, inclusive of both receptive and productive vocabulary knowledge. The analysis of scores attained by the participants for each item in the pre-tests show how participants demonstrated their receptive and productive knowledge prior to any explicit instructional mediation of vocabulary learning strategies in experimental groups.

6.3.1 Knowledge of Most Frequent Words in Pre-Tests (Receptive Vocabulary Knowledge)

Knowledge of word meanings of most frequent words in the texts were tested through multiple-choice items. As stated in chapter 4 of this thesis which outlined the rationale for test design, definitions of meaning of most frequent words were considered to demonstrate knowledge of receptive vocabulary in the study. For example, in test 1, the items that tested word definitions were selected from the most frequent words occurring in the reading text for pre-test 1 which were, *'power'*, *'grid,'* *'utility'* and *'solar'*. From the result analysis, it was noted that all participants scored 100% for word meanings of *'power'* and *'solar'*. However, the mean scores for participants from all groups were between 80%- 86.4% for defining meaning of the word *'grid'* and between 74% to 85% for providing the definitions of the meaning of the word *'utility',* indicating that even with most frequent word usage or receptive skills knowledge there was some variance in the way participants responded to knowledge of word frequency.

Table 6.3 shows participants' mean scores on items that tested knowledge of word definitions of the most frequent words in pre-test 1.

Table 6.3 Participants' mean scores for most frequent word knowledge in Pre-test 1

Groups	N=	*Power*	*Grid*	*Utility*	*Solar*
Group C	N=24	100%	81.90%	78.30%	100%
Group E	N=22	100%	86.40%	77.30%	100%
Group B	N=23	100%	82.70%	74%	100%
Group F	N=20	100%	80.0%	85%	100%

For Pre-test 2 , five items tested participants' knowledge of most frequent items from the reading text for pre-test 2 which were *'cell'*, *'stratosphere'*, *'satellite'*, *'powered'* and *'fleet'*. From the result analysis of the mean scores for pre-test 2, it was shown that the all the groups were able to demonstrate that they could define the word *'cell'* accurately with scores of 100%, however for knowledge of word meanings for *'stratosphere'*, the

participants' mean scores were between 89.3% - 94.1% and for the knowledge of word meaning for *'satellite'*, their mean scores were between 89.3% -93.4%. For knowledge of word meaning of *'powered'*, the participants' mean scores were between 91.2%-96.5% and for knowledge of word meaning for *'fleet'*, the participants' mean scores ranged from 90.6%-97.4%.

Table 6.4 shows participants' mean scores for items that tested knowledge of most frequent words in pre-test 2. They achieved varying results, once again indicating that not all most frequent words were known to participants although the words appeared most frequently in the engineering related reading text for pre-test 2.

Table 6.4 Participant Scores for Most Frequent Word Knowledge in Pre-test 2

Groups	N=	Cell	Stratosphere	Satellite	Powered	Fleet
Group C	N=24	100%	91.2%	90.5%	93.0%	95.3%
Group E	N=22	100%	89.3%	87.00%	91.2%	90.6%
Group B	N=23	100%	93.30%	89.3%	93.4%	97.4%
Group F	N=20	100%	94.10%	93.4%	96.5%	93.0%

In Pre-test 3, the four items that tested knowledge of most frequent words in the text were *'technology', 'install', 'enhancement'* and *'breakthrough'*. The results analysis of pre-test 3 showed that for knowledge of word meanings of the words *'technology', 'install' 'breakthrough'*, the participants scored 100%, but for the word 'enhancement' the mean scores ranged between 96.3-98.4% for the groups. In general, the results indicated that it was comparatively easy for participants to guess the meanings of words accurately for most frequent words in the text for pre-test 3, from the multiple-choices provided.

Table 6.5 shows how the participant groups performed in pre-test 3 for knowledge of most frequent words in text.

Table 6.5 Participant mean scores for most frequent word knowledge in Pre-test 3

Groups	N=	Technology	Install	Enhancement	Breakthrough
Group C	N=24	100%	100%	96.3%	100%
Group E	N=22	100%	100%	95.8%	100%
Group B	N=23	100%	100%	98.4%	100%
Group F	N=20	100%	100%	97.5%	100%

In Pre-test 4, the five items that tested knowledge of word meanings of most frequently occurring words in the text were: *'panels', 'system', 'engineering', 'thermal'*, and *'typical.* The analysis of results of pre-test 4 showed that all the participants scored 100% for knowledge of the words *'thermal'* and *'engineering',* and that the mean scores for the word *'panels'* were between 87.6%-95.3 %. For knowledge of the word *'system'* their mean scores were between 89.7%- 96.1% and for knowledge of the word *'typical'*, their mean scores were 78.5%-96.5%.

Table 6.6 illustrates how the participant groups scored on items that knowledge of most frequent words occurring in the text for pre-test 4.

Table 6.6 Participant Scores for Most Frequent Word Knowledge in Pre-test 4

Groups	N=	Panels	System	Engineering	Thermal	Typical
Group C	N=24	91.2%	89.7%	100%	100%	90.1%
Group E	N=22	87.6%	88.6%	100%	100%	78.5%
Group B	N=23	95.3%	94.2%	100%	100%	91.2%
Group F	N=20	88.6%	96.1%	100%	100%	96.5%

The analysis of Pre-tests revealed that participants scored fairly well in their knowledge of the most frequently occurring category. The CRT-achievement post-tests will show how the control and experimental performed on similar items after the explicit teaching of vocabulary learning strategies in experimental groups.

6.3.2Knowledge of Least Frequent Words in Pre-Tests (Productive Vocabulary Knowledge)

Depth of vocabulary knowledge of participants was tested through items in the reading texts for the pre-tests 1- 4 where participants demonstrated knowledge of the least frequently occurring words in the related texts. Knowledge of meanings in different contexts was tested through words that occurred least frequently in the texts. The depth of vocabulary knowledge indicated participants' productive vocabulary skills. The participants completed sentence completion tasks/gap-fill tasks using the least frequently occurring words or derivation of least frequent words in the technical / engineering-related texts.

In Pre-test 1, depth of vocabulary knowledge and knowledge of meanings in different contexts were demonstrated through five items, *'reliable, 'self-sufficient', 'alternative', 'generator',* and *'blackouts'*. Participants in the four groups scored lower in this category compared to receptive skills knowledge tasks, showing that their productive vocabulary skills were lower than their receptive skills.

Table 6.7 shows how the groups performed on the items that tested depth of vocabulary knowledge and knowledge of meanings in different contexts.

Table 6.7 Participant Scores for Least Frequent Word Knowledge in pre-test 1

Groups	N=	Reliable	Self-sufficient	Alternative	Generator	Blackouts
Group C	N=24	63.5%	59.4%	54.3%	67.3%	62.8%
Group E	N=22	66.5%	61.1%	64.3%	66.5%	57.5%
Group B	N=23	64.2%	63.2%	62.8%	64.3%	66.5%
Group F	N=20	58.5%	64.5%	65.0%	64.2%	60.2%

In Pre-test 2, the five items that tested participants' depth of knowledge of vocabulary and their ability to demonstrate knowledge of meanings in different contexts were the least frequently occurring words in the reading text for pre-test 2. The items were *'conventional', 'altitude', 'efficient', 'incentive'* and *'remote'*. Through demonstrating

knowledge of these words participants contributed to data on their productive vocabulary skills.

Table 6.8 illustrates the mean scores of participants in this category in pre-test 2.

Table 6.8 Participant mean scores for least frequent word knowledge in Pre-test 2

Groups	N=	Conventional	Altitude	Efficient	Incentive	Remote
Group C	N=24	62.8%	55.4%	57.3%	68.1%	56.5%
Group E	N=22	58.5%	60.1%	66.3%	64.5%	60.5%
Group B	N=23	63.5%	56.2%	65.8%	63.4%	58.2%
Group F	N=20	57.2%	61.5%	63.4%	60.3%	58.5%

In Pre-test 2, participants' mean scores were lower for depth of vocabulary knowledge tasks than for receptive vocabulary knowledge tasks, once again underscoring that productive vocabulary knowledge was lower in this group of participants.

In Pre-test 3, participants demonstrated their depth of vocabulary knowledge and knowledge of word meanings in different contexts through five items, contributing to knowledge of productive vocabulary. They illustrated their depth of vocabulary skills and lexical knowledge skills through sentence completion and gap fill tasks. Five least occurring words in the reading text for pre-test 3 tested productive vocabulary proficiency which were: *'stability', 'non-toxicity', 'absorber', 'technique'*, and *'convert'*.

Again the mean scores for participants in this category in pre-test 3 indicated that they had lower productive vocabulary knowledge.

Table 6.9 shows how participants fared in their depth of vocabulary knowledge.

Table 6. 9 Participant mean scores for least frequent word knowledge in Pre-test 3

Groups	N=	Stability	Non-toxicity	Absorber	Technique	Convert
Group C	N=24	52.8%	58.4%	57.3%	54.4%	58.5%
Group E	N=22	55.5%	63.2%	60.1%	61.1%	57.5%
Group B	N=23	57.5%	56.2%	60.8%	56.2%	54.2%
Group F	N=20	54.2%	64.5%	63.4%	61.5%	63.2%

In Pre-test 4, participants' depth of vocabulary knowledge and knowledge of meaning in different contexts were tested through five items. Participants' productive vocabulary knowledge was illustrated through their ability to complete sentences / gap fill tasks using the least frequently occurring words in pre-test test 4. The words that showed their skills in this category from the related technical / engineering-related text were: *ubiquitous', 'durable', 'viable', 'utilise'*, and *'array'*. The mean scores in productive knowledge category for pre-test 4 were lower than receptive vocabulary knowledge mean scores for all participant groups, indicating that this group of participants had lower productive vocabulary proficiency than receptive vocabulary proficiency.

Table 6.10 shows how participant groups scored in the productive vocabulary knowledge category in pre-test 4.

Table 6.10 Participant mean scores for least frequent word knowledge in Pre-test 4

Groups	N=	Ubiquitous	Durable	Viable	Utilise	Array
Group C	N=24	50.8%	58.4%	52.3%	53.4%	53.4%
Group E	N=22	51.5%	61.2%	60.1%	64.1%	52.2%
Group B	N=23	54.5%	58.2%	58.8%	61.2%	57.2%
Group F	N=20	53.2%	62.5%	56.7%	59.1%	60.1%

All the participant groups with a total of N= 89 participants demonstrated through the pre-tests 1, 2, 3 and 4 that their productive vocabulary knowledge was lower than their receptive

vocabulary knowledge through their performance on items that tested for knowledge of least frequent words occurring in the related reading texts.

6.3.3 Knowledge of Technical Vocabulary in Pre-Tests (Productive Vocabulary Knowledge)

Knowledge of important concepts was measured through testing knowledge of technical vocabulary occurring in reading texts for pre-tests 1, 2, 3 and 4. Participants in the groups provided explanations of technical words or phrases occurring in the texts in a few sentences by using their own words and using contextual clues available in the texts. Demonstration of this knowledge contributed towards measuring participants' productive vocabulary skills. In pre-test 1, three important concepts from the text selected as items measured participants' ability to describe in their own words the meanings of the phrases occurring in the text. These words occurred in low frequency in the text and participants had to use contextual clues to deduce meanings of the phrases. The phrases used in pre-test 1 to test technical knowledge were *'power-crisis'*, *'alternative energy'*, and *energy self-sufficient'*. The group participants demonstrated higher ability in this category compared to their productive vocabulary knowledge in the previous category, which tested depth of knowledge, indicating that they had better knowledge of technical vocabulary occurring in texts.

Table 6.11 illustrates how group participants performed in the technical knowledge category in pre-test 1. The participants' mean scores for this category ranged from 70.3%- 74.4%, indicating that their knowledge of technical skills was relatively good.

Table 6.11 Participant mean scores for knowledge of technical vocabulary knowledge in Pre-test 1

Groups	N=	Power Crisis	Alternative Energy	Energy self-sufficient
Group C	N=24	75.4%	72.4%	72.1%
Group E	N=22	70.3%	70.5%	71.3%
Group B	N=23	71.6%	71.3%	73.1%
Group F	N=20	74.3%	74.1%	74.3%

In Pre-test 2, three phrases connected to the main concepts / technical vocabulary knowledge occurring in the reading text demonstrated participants' technical knowledge. These phrases were *'high performance', wireless communications'*, and' *'prototype'*. The group participants' mean scores revealed that they had a better knowledge of technical vocabulary than depth of vocabulary knowledge demonstrated in pre-test 2.

Table 6.12 shows how group participants performed in this category in pre-test 2.

Table 6.12 Participants' mean scores for knowledge of technical vocabulary knowledge in Pre-test 2

Groups	N=	High performance	Wireless communication	Prototype
Group C	N=24	73.4%	70.4%	68.4%
Group E	N=22	72.3%	72.5%	70.3%
Group B	N=23	73.6%	75.3%	72.1%
Group F	N=20	75.3%	72.1%	74.3%

In Pre-test 3, three phrases characterised the main concepts /technical vocabulary used in the reading text for pre-test 3. These phrases were: *'silicon wafers', 'light absorption'* and *'wave length'*. These terms were specifically related to the content in the reading text for pre-test 3. Participants' ability to explain the meanings of these phrases in their own sentences by using contextual clues in the text showed their technical vocabulary knowledge and contributed to their productive vocabulary skills demonstration. The percentage of scores attained by the participants in technical vocabulary knowledge ranged from 68.4%- 75.3% illustrating their vocabulary capacity in this category.

Table 6.13 shows the mean scores of participants in technical vocabulary knowledge in Pre-test 3.

Table 6.13 Participants' mean scores for knowledge of technical vocabulary knowledge in Pre-test 3

Groups	N=	Silicon wafers	Light absorption	Wave length
Group C	N=24	62.3%	59.3%	62.1%
Group E	N=22	61.4%	56.3%	63.2%
Group B	N=23	62.1%	57.3%	65.3%
Group F	N=20	62.9%	58.1%	61.4%

In Pre-test 4, three phrases that tested their knowledge of technical vocabulary were *'silicon wafers', 'light absorption'*, and *'wave length'*. The mean scores were uniform for all groups for this category with a range of 62.5%- 66.1%.

Table 6.14 shows the mean scores for technical vocabulary knowledge all group participants in pre-test 4.

Table 6.14 Participants' mean scores for knowledge of technical vocabulary knowledge in Pre-test 4

Groups	N=	*Green house gases*	*Emissions*	*Two-dimensional*
Group C	N=24	65.1%	65.4%	62.4%
Group E	N=22	63.4%	66.1%	63.3%
Group B	N=23	62.5%	63.2%	64.1%
Group F	N=20	64.5%	63.8%	62.3%

6.4 Results of Criterion-referenced Post–Tests

The next section provides the summary of the post-test results and explains the details of the scores attained in the post-tests by the standard groups and details of descriptive data scores achieved in post-tests by experimental groups as only achievement tests are able to measure what has been taught directly or explicitly.

Figures 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 6.15 and 6.16, show the frequency and scores in post-test results in groups C, E, B and F for tests 1 and 2 and tests 3 and 4.

Figure 6.9- Post-test Scores for Group C (Tests 1 and 2)
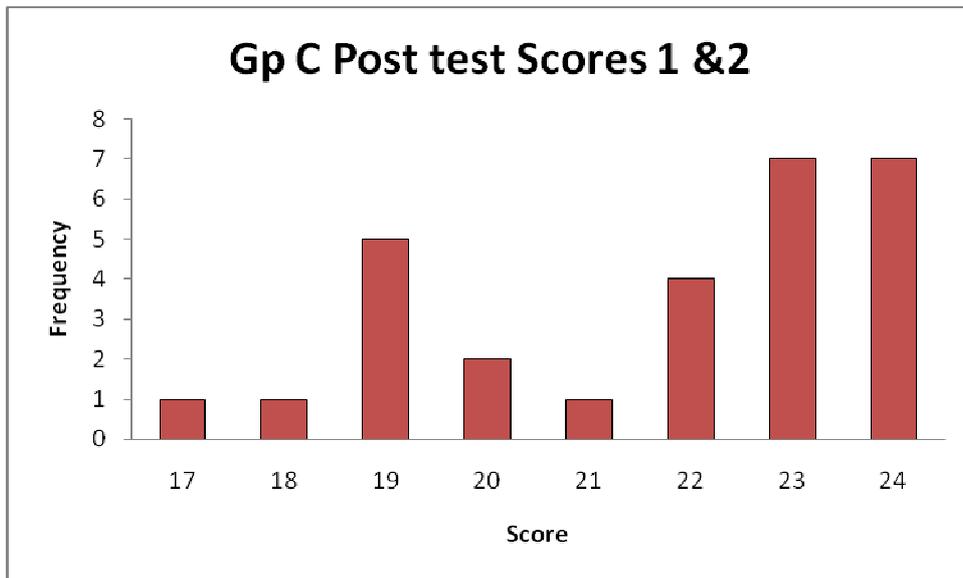
Figure 6.10- Post-test Scores for Group C (Tests 3 and 4)
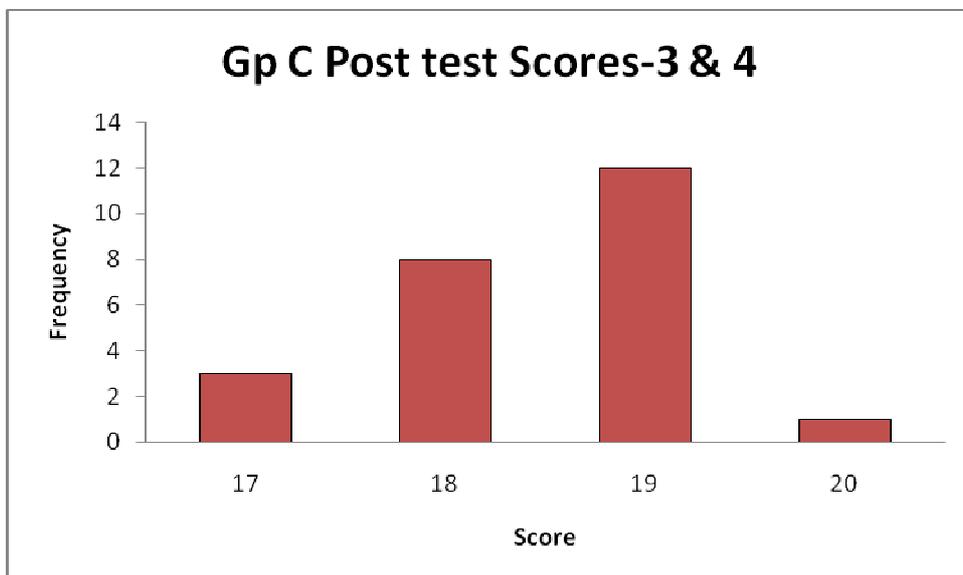
The Post-test results for test 1 and 2 and 3 and 4 scores for experimental group C show that the mean scores attained were 21.3 and 18.4 and the coefficient reliability was + 1 showing reliable and consistent results. The mean scores had increased from 17.5 to 21.3 in

tests 1and 2 and from 16.9 to 18.4 in tests 3and 4 for the experimental group C showing <mark>noteworthy</mark> incremental vocabulary gains.

Figure 6.11- Post Scores for Group E (Tests 1 and 2)
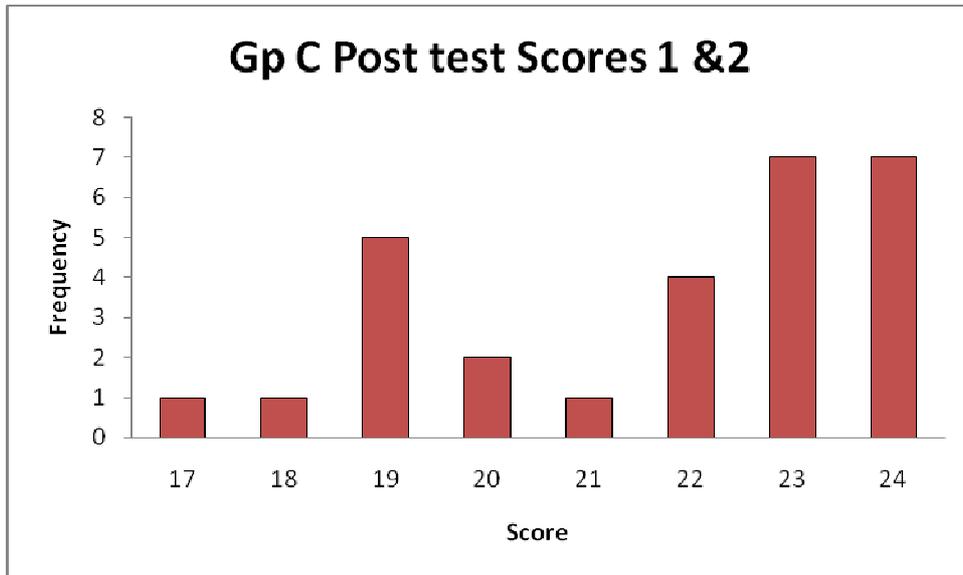
Figure 6.12-Post-test Scores for Group E (Tests 3 and 4)
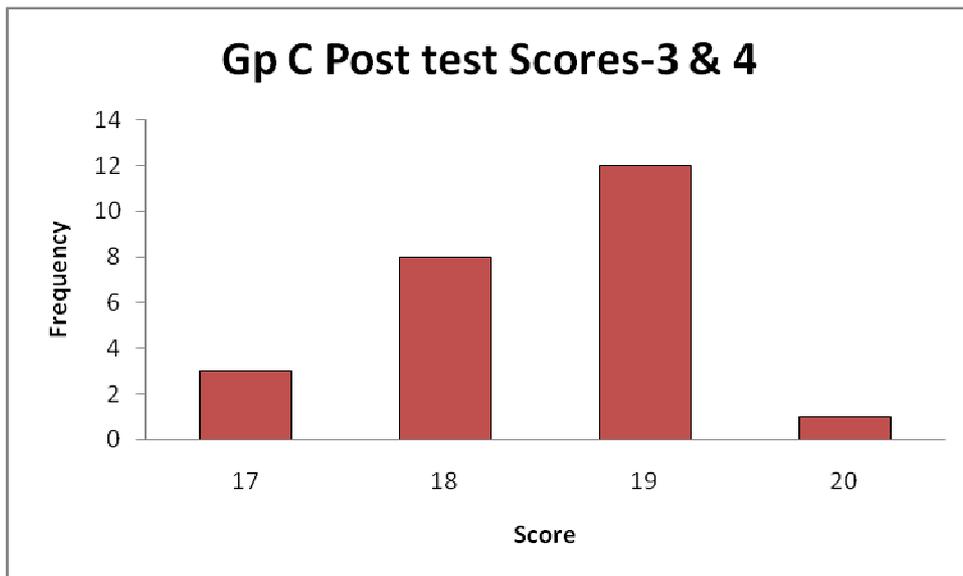
The Post-test results for test 1 and 2 and 3 and 4 scores for experimental group E show that the mean scores attained were 22 and 18.4 and the coefficient reliability was +1 indicating reliable results. The mean scores had increased in the post-tests for the experimental group E from 17.8 in pre-tests 1 and 2 to 22 in the post-tests 1 and 2 and from 15.3 in the pre-tests 3 and 4 to 18.4 in post-tests 3 and 4 showing that vocabulary gains had indeed occurred significantly as result of explicit teaching of vocabulary strategies.

Figure 6.13 Post-Test Scores for Group B (Tests 1 and 2)
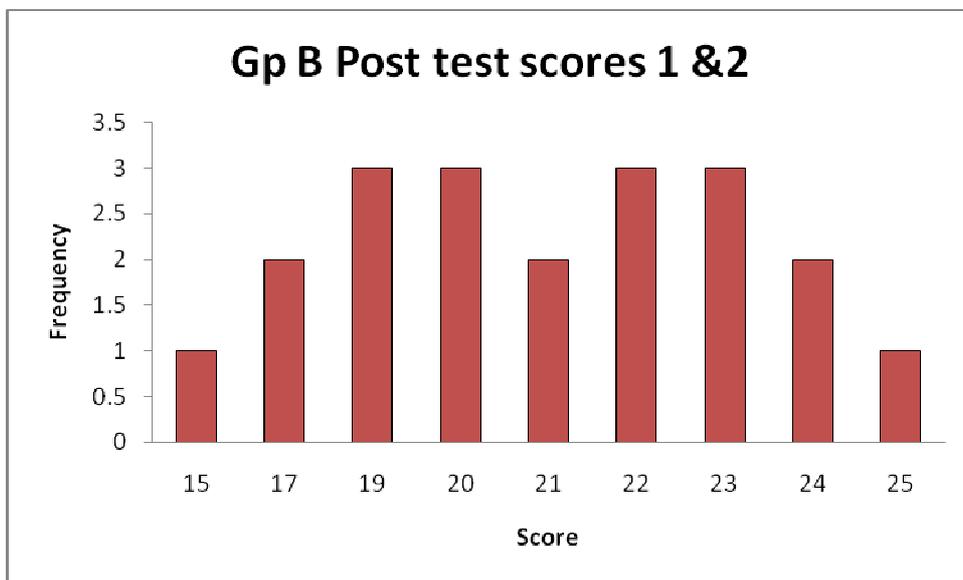
Figure 6.14 Post-Test Scores for Group B (Tests 3 and 4)
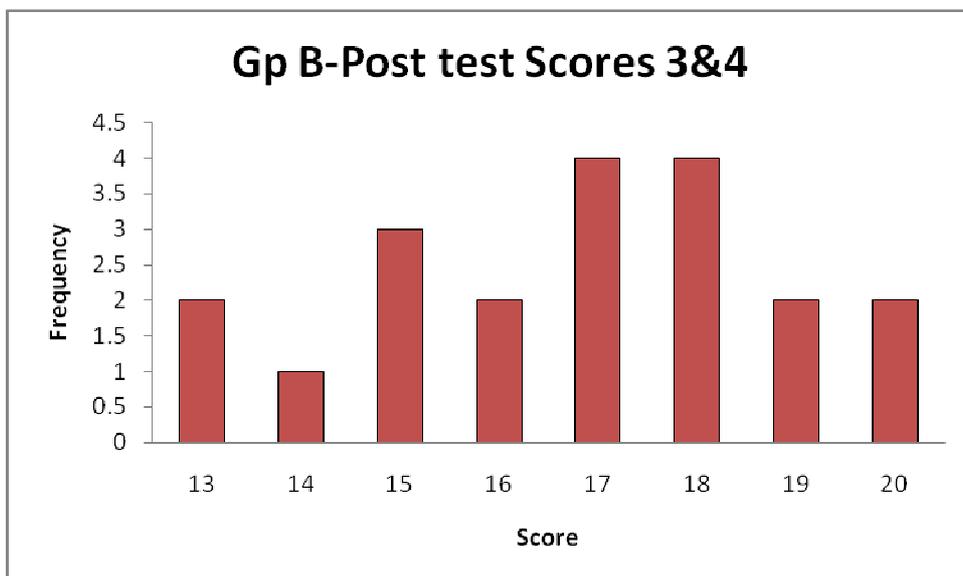
The Post-test results for test 1 and 2 and 3 and 4 scores for control group B show that the mean scores attained were 20.8 and 16.75 and the coefficient reliability was 1 indicating reliable results. There was a slight increase in vocabulary mean scores for tests 1and 2, however the mean scores for test 3and 4 remained the same 16.7. The vocabulary gains were minimal in this control group as compared to vocabulary gained by experimental groups C and E.

Figure 6.15 Post Test Scores for Group F (Tests 1 and 2)
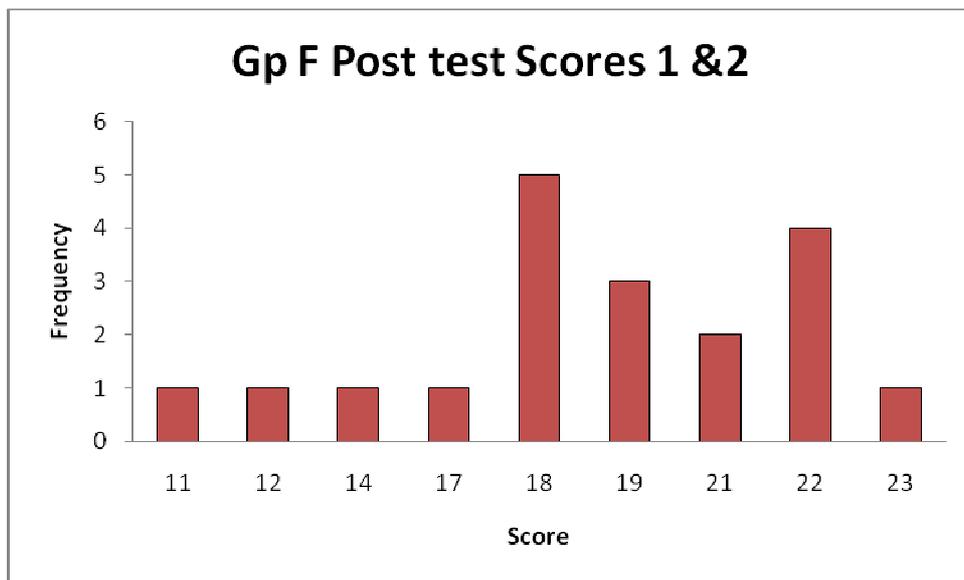
Figure 6.16 Post Test Scores for Group F (Tests 3 and 4)
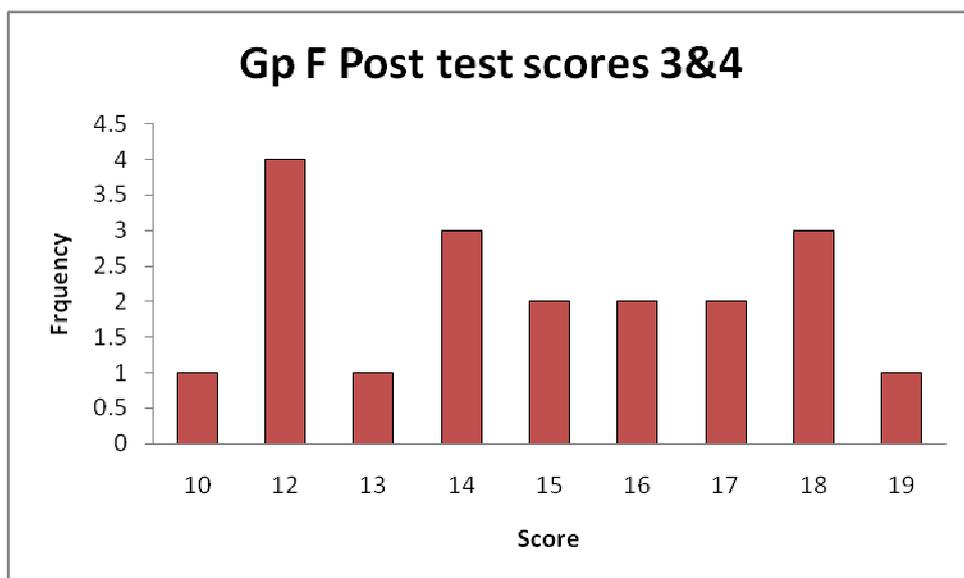
The Post-test results for test 1 and 2 and 3 and 4 scores for control group F show that the mean scores attained were 18.6 and 14.8 and the coefficient reliability was +1 indicating reliable results. The mean scores had remained in the same range of 19 to 19.1 in pre and post tests 1 and 2 but had slightly decreased in post-tests 3 and 4 from 19 to 14.8. These results show the variance in scores attained by experimental and control groups and illustrate the vocabulary gains achieved by experimental groups as compared with control groups.

## 6.5 Summary of Results for Items in Post tests

The results from the CRT-achievement tests for experimental and control groups indicate that participants in the experimental groups had performed much better than participants in control groups on items that tested for recognition skills, lexical knowledge, depth of vocabulary knowledge, meanings in different contexts and technical vocabulary proficiency. The results validate that explicit teaching of vocabulary learning strategies assist in developing vocabulary in L2 learners. The next section shows how participants scored on items in the post-tests.

Comparisons of pre-test scores on each item in the CRT diagnostic tests given on pages 184-193 of this chapter and comparisons of how participants performed on items from post tests as described in pages 199- 206 assist in understanding gains in vocabulary attained by the experimental group of participants.

6.5.1 Knowledge of Most frequent words in Post-Tests

The results analysis of mean scores for CRT-achievement tests showed that the participants in experimental groups C and E had performed much better than participants in control groups B and F for knowledge of most frequent words. Once again experimental groups C and E showed that they had made gains in their demonstration of productive vocabulary skills when compared with the performance of control groups B and F in the Post-tests for this category.

Table 6.16 shows how participants performed on items that tested most frequent words in CRT-achievement Post test 1.

Table 6.16 Participants' mean scores for knowledge of most frequent words in Post-test 1

Groups	N=	*Power*	*Grid*	*Utility*	*Solar*
Group C	N=24	100%	96.30%	89.30%	100%
Group E	N=22	100%	98.30%	88.50%	100%
Group B	N=23	100%	80.70%	75%	100%
Group F	N=20	100%	78.0%	83%	100%

The results indicate that the participants from experimental groups had gained better receptive vocabulary proficiency skills than their counterparts in the control groups as their percentage of accuracy in post-test 1 had increased quite significantly. It was noted that participants in experimental groups had gained 11.0% to 14.5% increase in mean scores demonstrating their improved ability to define the most frequent words in post-test 1. Whereas, the mean scores for participants in the control groups for most frequent words in post-test 1 had slightly increased by less than 1% or remained the same or were slightly reduced (1- 2%) due to reasons not known.

Table 6.17 shows the mean scores for knowledge of most frequent words in Post-test 2 for all groups.

Table 6.17 Participants' mean scores for knowledge of most frequent words in Post-test 2

Groups	N=	*Cell*	*Stratosphere*	*Satellite*	*Powered*	*Fleet*
Group C	N=24	100%	98.3%	99.0%	97.0%	99.4%
Group E	N=22	100%	97.5%	98.60%	98.5%	98.1%
Group B	N=23	100%	92.30%	89.3%	94.0%	98.0%
Group F	N=20	100%	93.10%	93.4%	95.0%	96.0%

Participants in experimental groups C and E demonstrated an increase in mean scores for knowledge of most frequent words in post-test 2 compared with standard group participants from B and F. The participants in the experimental groups had shown an increase in their percentage mean scores for knowledge of most frequent words in post-2 by 4.5-8.5% as compared to their scores in Pre-test 2 for the same category. The standard group participants B and F showed very little change in the scores attained in this category compared to their scores in Pre-test 2. The variation in their scores in Pre-test 2 and Post test 2 for items was less than 1%.

Table 6.18 shows how participants performed on items that tested knowledge of most frequent words in Post-test 3 through their mean scores.

Table 6.18 Participants' mean scores for knowledge of most frequent words in Post-test 3

Groups	N=	Technology	Install	Enhancement	Breakthrough
Group C	N=24	100%	100%	99.3%	100%
Group E	N=22	100%	100%	98.8%	100%
Group B	N=23	100%	100%	98.2%	100%
Group F	N=20	100%	100%	97.6%	100%

In post-test 3 the mean scores attained by experimental groups demonstrated a slight increase in their ability to define the most frequent words. All groups had attained 100% in their knowledge of 3 items tested for receptive vocabulary. However, the experimental groups showed that in the post-tests they had gained a 3 % growth in their knowledge of the word '*enhancement*' as used in the reading text for post-test 3 indicating positive change as a result of explicit teaching of vocabulary learning strategies.

Table 6.19 shows how participants' mean scores for items that tested for knowledge of most frequent words in Post-test 4.

Table 6.19 Participants' mean scores for knowledge of most frequent words in Post-test 4

Groups	N=	Panels	System	Engineering	Thermal	Typical
Group C	N=24	97.3%	96.5%	100%	100%	98.1%
Group E	N=22	98.6%	97.4%	100%	100%	94.5%
Group B	N=23	96.0%	94.7%	100%	100%	92.3%
Group F	N=20	91.2%	96.6%	100%	100%	97.0%

In Post-test 4 participants in the experimental groups C and E showed significant gains in mean scores on items that tested for knowledge of most frequent vocabulary with a range of 6.1% - 11 % positive achievement. In comparison, the standard groups B and F showed only a slight change in mean scores with -1% - +1% indicating their scores had changed only slightly. Overall the results of the post-tests indicate that experimental groups demonstrated increased knowledge of receptive vocabulary skills through items that tested their knowledge of most frequent words.

6.5.2 Knowledge of Least Frequent Words in Post-Tests

The analysis of CRT-achievement tests mean scores showed how the groups demonstrated knowledge of least frequent words in Post-tests indicating their productive vocabulary proficiency. Once again experimental groups C and E showed that they had made ==critical== gains in their demonstration of productive vocabulary skills when compared with the performance of control groups B and F in the Post-tests for this category.

Table 6.20 shows participants' mean scores for items that tested knowledge of least frequent words occurring in Post-test 1.

Table 6.20 Participants' mean scores for knowledge of least frequent words in Post test 1

Groups	N=	Reliable	Self-sufficient	Alternative	Generator	Blackouts
Group C	N=24	75.5%	71.5%	70.6%	78.3%	74.1%
Group E	N=22	77.4%	73.4%	73.3%	77.6%	76.3%
Group B	N=23	65.2%	64.1%	62.6%	65.6%	67.3%
Group F	N=20	59.5%	65.3%	64.1%	65.2%	62.6%

The score analysis for the least frequent words in post test 1 shows that experimental groups C and E participants made significant gains in their depth of vocabulary and lexical knowledge skills. The percentage of vocabulary increase in the groups ranged from 9% to 18.8% for the experimental groups. The most significant gain of 18.8% was made by group E on the word *'blackouts'*. Group C made a fairly considerable gain of 16.3% on the word *'alternative'* in Post test 1. Meanwhile the control groups B and F were noted to have variances in percentage 1% or less than 1% on all items in the least frequent word category showing that their depth of vocabulary lexical knowledge had remained constant.

Table 6.21 shows how participants scored in items that tested knowledge of least frequent words in Post test 2.

Table 6.21 Participants' mean scores for knowledge of least frequent words in Post test 2

Groups	N=	Conventional	Altitude	Efficient	Incentive	Remote
Group C	N=24	70.5%	71.2%	69.0%	76.4%	68.4%
Group E	N=22	68.3%	69.3%	73.4%	72.8%	74.5%
Group B	N=23	64.2%	56.2%	65.8%	63.4%	58.2%
Group F	N=20	59.0%	62.1%	63.4%	60.3%	58.5%

The analysis for scores in least frequent word knowledge in post test 2 shows that the experimental groups C and E had advanced notably in depth of vocabulary knowledge and lexical knowledge. The gain in percentage of knowledge was between 7.1 %-15.8%. The maximum gain in scores was made by group C in their knowledge of use of the word *'altitude'* with 15.8 %, while group C showed a marked increase in ability to use the word 'remote' in Post-test 2 with a 14% increase in mean scores.

Table 6.22 shows the groups performed in tasks that tested knowledge of least frequent words in Post-test 3.

Table 6.22 Participants' mean scores for knowledge of least frequent words in Post test 3

Groups	N=	Stability	Non-toxicity	Absorber	Technique	Convert
Group C	N=24	64.3%	67.6%	69.0%	67.6%	70.1%
Group E	N=22	68.2%	71.6%	72.7%	73.8%	68.4%
Group B	N=23	58.3%	56.9%	61.2%	57.1%	55.1%
Group F	N=20	55.1%	65.1%	64.1%	62.3%	63.8%

The analysis of the mean scores for knowledge of least frequent words in Post-test 3 show that experimental groups C and E had gained in depth of vocabulary and lexical knowledge skills, in comparison to control groups B and F. The range of percentage increase in the mean scores was between 8.4% - 13.2%. The highest gain was made by group C on the item that tested knowledge of the word *'technique'* with 13.2 % ,and the highest gain by group E was 12.7 % on the words *'stability'* and *'technique'*. In comparison, the control groups showed an increase or decrease in depth of vocabulary and lexical knowledge of -1% - +1% indicating that their knowledge had remained fairly constant throughout the 12 week semester.

Table 6.23 shows the mean scores for participants for knowledge of least frequent words in Post test 4.

Table 6.23 Participants' mean scores for knowledge of least frequent words in Post test 4

Groups	N=	Ubiquitous	Durable	Viable	Utilise	Array
Group C	N=24	65.7%	66.3%	63.9%	65.4%	64.8%
Group E	N=22	62.4%	70.5%	68.7%	69.6%	66.5%
Group B	N=23	55.1%	58.6%	58.0%	60.8%	57.6%
Group F	N=20	54.1%	61.8%	57.1%	60.0%	60.8%

The mean scores analysis showed that the experimental groups C and E had gained in depth of vocabulary and lexical vocabulary knowledge skills. The percentage gain in mean scores ranged between 5.5%- 14.9% for the experimental groups. The highest gain in percentage of mean scores was made by group C on the knowledge of word *'ubiquitous'* with an increase of 14.9% , whereas for group E the highest gain in percentage was on the

knowledge of word *'array'* with 14.3% increase. The mean scores for control groups B and F in knowledge of least frequent words in Post- test 4 had remained constant with a loss or increase of -1%- +1%.

6.5.3 Knowledge of Technical Vocabulary in Post-Tests

The analysis of mean scores in CRT-achievement post tests 1, 2, 3 and 4 demonstrated that experimental groups C and E had gained better productive vocabulary knowledge as a result of instructional mediation when compared with control groups B and F. The mean scores achieved on items that tested their technical knowledge skills illustrated the productive vocabulary skills of group participants.

Table 6.24 shows the mean scores of group participants for demonstration of knowledge of technical vocabulary in Post test 1.

Table 6.24 Participants' mean scores for technical vocabulary knowledge in Post-test 1

Groups	N=	*Power-crisis*	*Alternative energy*	*Energy self-sufficient*
Group C	N=24	88.3%	78.6%	84.3%
Group E	N=22	87.3%	76.5%	82.6%
Group B	N=23	72.3%	71.7%	74.0%
Group F	N=20	73.8%	74.8%	74.8%

The analysis of the mean scores for technical vocabulary attained by the participants in experimental groups C and E in Post-test 1 show that the percentage gains in mean scores ranged from 6.0% - 12.9%. Group C had attained the highest percentage gain of 12.9% for knowledge of the word 'power-crisis'. Group E gained the highest percentage in mean scores for knowledge of the phrase *'energy self-sufficient'* with an increase of 12.2%. The mean scores for control groups B and F in technical vocabulary knowledge showed less than 1% increase indicating their productive vocabulary skills had remained quite even.

Table 6.25 shows how participants performed in items that tested knowledge of technical words in Post-test 2.

Table 6.25 Participants' mean scores for technical vocabulary knowledge in Post-test 2

Groups	N=	*High perfomance*	*Wireless communication*	*Prototype*
Group C	N=24	88.3%	87.2%	87.3%
Group E	N=22	87.6%	88.5%	86.9%
Group B	N=23	72.8%	76.1%	73.0%
Group F	N=20	74.7%	71.5%	75.1%

The results analysis of mean scores for technical knowledge vocabulary in Post-test 2 show that experimental groups C and E had increased their productive vocabulary knowledge. Group C and E had gained the highest percentage increase for knowledge of the word *'prototype'* with an 18.9% increase in mean scores for group C, and 16.6% increase in mean scores for group E. The control groups B and F showed that their knowledge of technical words had remained the same in post test 2 with a variance of less than 1% on all items tested.

Table 6.26 shows how participants performed in technical vocabulary knowledge in Post test 3.

Table 6.26 Participants' mean scores for technical vocabulary knowledge in Post-test 3

Groups	N=	*Silicon wafers*	*Light absorption*	*Wave length*
Group C	N=24	74.3%	73.9%	68.4%
Group E	N=22	75.2%	75.8%	69.4%
Group B	N=23	62.8%	58.1%	66.1%
Group F	N=20	63.4%	58.8%	62.0%

The mean score analysis for participant groups for knowledge of technical vocabulary knowledge in Post-test 3 illustrates that experimental groups C and E performed better than control groups B and F. The range of increase in mean scores for experimental groups C and E was between 6.2%- 19.6%.

Both experimental groups C and E showed the highest increase in percentage in their mean scores for knowledge of the word *'light absorption'* with group C showing a 14.6% increase and group E showing 19.6% increase in mean scores. The control groups did not show any significant increase or decrease in mean scores for technical vocabulary knowledge with a variance of less than 1% in mean scores attained.

Table 6.27 shows the mean scores achieved by participants in knowledge of technical vocabulary in Post test 4.

Table 6.27 Participants' mean scores for technical vocabulary knowledge in Post-test 4

Groups	N=	Green house gases	Emissions	Two-dimensional
Group C	N=24	77.4%	78.3%	75.3%
Group E	N=22	76.5%	76.5%	77.2%
Group B	N=23	63.2%	62.0%	64.8%
Group F	N=20	65.1%	62.5%	63.1%

The results of post-test 4 for technical vocabulary knowledge show that experimental groups C and E performed better than control groups B and F. The advancement in vocabulary gains for the experimental groups ranged from 10.4%- 13.9%. Experimental group C and E showed the highest percentage increase in knowledge of the word *'two-dimensional',* with 12.9% and 13.9% increase respectively. The control groups B and F showed that their knowledge of technical vocabulary had remained constant with a less than 1% variance in mean scores for technical vocabulary knowledge in Post test 4.

6.6 t-Tests Results

In order to find out whether the groups differed from each other with respect to their total vocabulary gain scores at the end of the study, *t*-tests were conducted between the experimental and standard groups. As can be seen, there was a notable difference between the control groups and experimental groups in terms of their vocabulary knowledge gain

scores with the experimental groups showing a marked increase in vocabulary achievement scores.

In summary, the experimental groups had clearly shown progressive gains in vocabulary mean results. This is verified through the *t*-test results. The vocabulary gains achieved by the experimental groups E and C are demonstrated through the *t* tests results for control groups B and F and experimental groups C and E.

Table 6.28- *t*-test Scores for test 1 and 2

	Gp B	Gp F
Gp C	0.005430863	0.000126048
Gp E	0.003722189	0.000005247

Table 6.29- *t*-test Scores for test 3 and 4

	Gp B	Gp F
Gp C	0.000137889	0.0000000984
GpE	0.000216443	0.0000001541

The *t*-tests conducted between control and experimental groups show significance (*p)* values ranging between 0.005 and 0.0002, indicating a high degree of significance as the current study employed an independent sample *t*- test which is a one-tailed t-test with the level of significance set (p) as = 0.01.

The test results indicate that the experimental groups demonstrated an incremental understanding of word meanings and relationships including the ability to use context to infer word meanings from texts. In addition, the experimental groups showed better skills in decoding and word-reading abilities and the ability to use derivations of words in different contexts through the test items that focussed on these skills. The five aspects of lexical knowledge tested were recognition skills, lexical knowledge, depth of vocabulary knowledge, vocabulary meaning in different contexts, knowing how to use the word in different situations and technical vocabulary knowledge. The experimental groups demonstrated better ability in the above lexical skills confirming the effectiveness of explicit

teaching of vocabulary learning strategies. It appears that the explicit instructional mediation and the preparation the experimental group received about inferencing strategies and constructing meaning from context contributed to the expansion of their mental lexicon. In addition, the experimental groups demonstrated better abilities in coping with comprehension of technological texts as shown in the post-test performances on items they had had difficulties prior to receiving the instructional mediation. The experimental groups showed that they had more suitable vocabulary learning strategies and had improved their lexical knowledge after they had received explicit instruction on better vocabulary learning strategies.

6.7 Discussion on Findings in Phase Two

The results seem to indicate that instructional mediation is relevant in vocabulary learning environments in tertiary settings. As a framework to interpret findings, vocabulary learning and teaching viewpoints by Meara (1996); Dole (1995); Nunan (1998); Gu (2003) and Pulido (2008) were adopted. The results of findings in phase two indicate that explicit vocabulary instructional practices for developing engineering and technical vocabulary development in meaningful and discipline / domain contexts must be encouraged.

The results strengthen the notion that comprehension is a multifaceted cognitive practice that is integral to acquiring vocabulary and that to achieve this, linguistic inputs must be decoded logically for vocabulary acquisition to occur as suggested by Pulido (2008).The results encourage the fact that in addition to the vocabulary skills, characteristics, and language proficiency that study participants bring to the reading task, they were influenced by the inferencing strategies taught to them. It further confirms that vocabulary development occurs when facilitators engage in mediating. The results appear to indicate that the prior knowledge of the target language in L2 learners and learning experiences supported by instructional practices in specialised discipline areas are necessary in order to advance in L2 vocabulary proficiency. These concepts have been well established by other vocabulary researchers (Ellis, 1994; Hu & Nation, 2000, Laufer, 1997; Nagy; 1997; Nation, 2001; Pulido, 2003). The results point towards that specific reading practices which complement L2

learner inferencing strategies when introduced via explicit instruction assist in advancing vocabulary in L2 learners. The results suggest that acquiring productive knowledge of a word is a more complex task than acquiring receptive knowledge of it as acknowledged by researchers (Laufer, 1998; Nation 1990).

During the 12 week course of study, although the focus in both experimental and control groups were on similar topics such as academic writing and scholarship, report writing within engineering academic and professional contexts, developing reflective learning and oral communications skills and developing team work skills, the outcomes from the groups varied greatly. The instructional mediation in experimental groups had specifically exposed them to learning vocabulary in context. In the sessions which were dedicated to demonstrating improvement in written and oral communication with a focus to using logical, succinct language appropriate to engineering, the experimental groups were continuously encouraged to use inferencing strategies- cognitive, meta-cognitive, memory and social, which yielded positive results. The results of *t*-tests confirm that raising awareness of inferencing strategies and modelling individual strategy use in the classroom appears to be effective. The encouragement given to participants in the experimental groups to interact and discuss effective strategies among themselves bring to focus the importance of social learning and peer learning constructs. The fact that the vocabulary learning strategies were introduced to the experimental group participants contextually raises a crucial characteristic of the role of context in L2 vocabulary instruction. It ascertains the notion that vocabulary ought to be presented and taught in context in tertiary domains or realms. Further discussions on pedagogical implications of teaching vocabulary in context will be extended in the concluding chapter.

The results also appear to indicate that L2 learners from specific disciplines such as engineering are able to engender acquisition of specific technical vocabulary through various learning tasks such as writing engineering reports for projects and site visits, and through conducting seminar presentations when explicit instructional strategies assist technical and discipline-related vocabulary production. The study results strengthen the viewpoint that reading and understanding relevant texts are useful in developing requisite vocabulary skills, although in L2 learners with low proficiency this may be impeded and the reading task can be difficult and be lexically dense as has been shown in verbal protocols

discussed in chapter 5 of this thesis. The results from the study illustrate that vocabulary learning should be encouraged through specific strategies that correspond to individual needs and skills and knowledge of pre-receptive vocabulary as specified in the PR-PV conceptual theoretical model developed in this study.

Essentially the findings in the study seem to intimate that the learners' knowledge of discipline concepts and proficiency interrelate with the realisations of task circumstance, leading to different vocabulary learning outcomes. It is to be recognised that learner conflict occurring between understanding the content of texts and learning new words during reading of the text may compel L2 learners to select a range of inferencing strategies that may or may not lead to vocabulary production, especially in the case of linguistically less proficient L2 learners.

The findings from the present study support reports from other studies as well as espouse that effective vocabulary teaching programs should comprise guiding students to select words that are related to the important elements of a text, teaching those words in context and providing opportunities for multiple practices of using the words (Dole, 1995).

The findings also seem to confirm that it is possible to achieve textual connectivity or the 'sense of unity' described by Nunan (1998, p.22) through making accurate associations between the different words and expressions in the sentences of a text assisted through instructional mediation. Literature Review in this thesis has analysed linguistic learning theories and theoretical models that guide comprehension processes and vocabulary development. One notion in vocabulary learning directly linked to reading is "schema" and schema theory conceptualises that knowledge is arranged in interrelated patterns and are constructed from prior learning experiences. These concepts are validated through the findings of the present study. In this respect, it is possible to accept schema theory as a well-founded concept in reading as it demonstrates that knowledge is arranged in inter-connected patterns and is linked to prior learning experiences.

The results are in summary, indicative of the fact that effective vocabulary instruction advances comprehension and vocabulary gains.

6.8 Validating the Pre-receptive (PR)-to Productive (PV) Vocabulary Development Model

The *t*-test results of the CRT- achievement tests obtained by study participants in the experimental groups show the incremental gains achieved by the participants in the experimental groups in which explicit teaching of inferencing strategies in reading and vocabulary learning were introduced. As referred to in the theoretical, conceptual PR-PV vocabulary development model developed in the study, the vocabulary learning practices of the study participants were comparable, where L2 vocabulary learning needed to account for prior learning experiences of the learners, specifically *pre-receptive vocabulary*.

As stated previously, *pre-receptive vocabulary* proficiency refers to the vocabulary proficiency of the L2 learner where L2 learner receives new words for the first time. In this state the L2 learner has an established L1 schema quite unlike the individual's L2 schema and the L2 is then developed through connections with the foundations of language learning established earlier through the acquisition of the learner's L1. The fact that Chinese / Malay are non cognate to English limited the L2 learners in the study to draw upon their knowledge of cognates in their L1 to determine the meanings of the words in the L2. As cited in the PR-PV vocabulary development model, and supported through verbal protocol on vocabulary learning strategies provided by study participants, when a new word is encountered by the L2 learner, the learner attempted to recognise the word through translation or sometimes through L1 matches. The L2 learners relied on various lexical strategies to construct meaning and comprehension of the word. Context cues were used by more proficient L2 learners through lexical positioning and lexical entries such as semantic, syntactic, morphological and formal entries, both implicative and explicative. L2 learners also acquired vocabulary in social and peer learning contexts. The fact that they had similar or shared L1 may have encouraged this practice. However, this detail can only be ascertained through more specific studies.

Verbal protocol gathered in phase one established that when L2 learners encountered words with low frequency they attempted to construct meaning and comprehension according to their proficiency level and used diverse strategies to arrive at meanings. The lexical density of the text played a great role in the inferencing skills selected. Learners mostly dealt with unknown words in the text by finding matches in their corresponding L1 through transfer strategies or drawing inferences from the context.

As outlined in the PR-PV vocabulary development model, several transfer strategies had been attempted by the L2 learners in the study, such as referring to dictionaries, both mono-lingual and bi-lingual, referring to more knowledgeable peers, and referring to contextual clues for understanding meanings of unknown words. Prior knowledge, background knowledge and multiple exposures to words may be taken as contributing to the development of reading competence. The study draws attention to the fact that there is a need to raise the meta-cognitive awareness and the awareness of multiple, lexical and inferencing strategies in L2 learners as specified in the PR-PV vocabulary development model. Vocabulary production processes activated in the mental lexicon through appropriate inferencing strategies supported by instructional mediation had indeed led to the advancement of productive vocabulary thereby validating the PR-PV vocabulary development model developed through the study.

6.9 Summary of Chapter

The context in which the L2 learner is engaged, which includes peers, needs of the of discipline of the L2 learner, and the contexts of pre-receptive - productive vocabulary learning(PR-PV) is underscored in the present study. Also the notion of lexical density which is not accounted in L2 models of vocabulary learning is accentuated here. The concept of schema theory and textual connectivity framed the discussions. However, as ascertained in the theoretically derived instructional model for pre-receptive to productive learning (PR-PV model) the interaction of lexical entries, lexical density, inferencing of contextual clues,

frequency of word occurrence and selection of lexical strategies and meta cognitive schemata and production processes in the mental lexicon of L2 learners are known to be multi-faceted and significant.

The social learning environments in which the vocabulary learning strategies are employed by students and the role of instructional mediation in tertiary L2 learning settings are accentuated in the present study. In particular, the study was guided by the research questions on how explicit reading instruction assist L2 learners in developing productive vocabulary and lexical schema from context.

The next chapter presents the conclusion of this thesis in which the significance, limitations, implications and recommendation for further research on the subject matter are discussed.

Chapter-7 Conclusion

The major findings from the study appear to confirm that explicit teaching of vocabulary learning strategies correlates with the development of productive vocabulary. It is important for vocabulary learning and instruction to take note of the fact that vocabulary knowledge encompasses both depth of vocabulary knowledge and breadth of vocabulary knowledge. The study believes that effective instruction of vocabulary strategies, connecting with L2 learners through word-focussed activities, and providing L2 learners with attempts for frequent practice for word production are the best ways through which vocabulary development can be advanced in L2 learners from tertiary backgrounds.

7.1 Pedagogical Implications of Study

The findings suggest that there may be many pedagogical implications that could be of particular significance to instructors and academics involved in curriculum building activities focussing on vocabulary development in L2 learners. It appears that through supportive study environments and development of awareness of vocabulary inferencing and vocabulary learning strategies, it is possible for L2 learners to learn meanings of new words and to consolidate their knowledge of words better. The findings from the study elucidate the various strategies and knowledge sources L2 learners refer to in order to infer meanings of unknown words encountered in the reading texts. The findings suggest that contextual learning of word meanings may be encouraged in a tertiary L2 environment. Through contextual understanding of new words L2 learners may learn not only the syntactic and paradigmatic relations of the new words with other words but also use these associative links to form schematic patterns in their mental lexicon. The sections below highlight the key concepts ascertained from the findings

7.1.1 Encouraging Inferencing Strategies

Instructors should encourage L2 vocabulary learners to use appropriate inferencing strategies to acquire word meanings independently when they encounter new words in reading. The CRT-achievement tests results from the study demonstrated that participants in the experimental groups had enhanced their knowledge of word forms when compared with participants in the control groups which validates the practice of raising awareness in L2 learners regarding inferencing strategies. Explicit teaching of vocabulary learning strategies aided in the ability of L2 learners to use different forms of words in different contexts. This knowledge is noteworthy as breadth of meaning knowledge is correlated with knowing different senses of words. Instructional mediation benefited L2 learners as the experimental group participants who were explicitly taught vocabulary learning strategies demonstrated greater depth of meaning and precision of meaning in knowledge of using words in different situations.

Findings from the study indicate that explicit teaching of vocabulary supported L2 learners to develop capacity for expressing a range of lexical knowledge such as generalisation in domain or knowing definitions. This knowledge is crucial, as being able to define a word in context is representative of the knowledge of lexical semantics in context. As such, instructors must raise awareness in L2 learners about the roles definitions and contexts play in reading. For context analysis, the participants in the study demonstrated that knowing a word not only means knowing roles and relations with other words, but also being able to interpret its meanings in particular contexts. The study seems to confirm that inferring meaning from contexts (Hunt & Beglar, 2005) has a positive influence on vocabulary production. However, this was only possible when L2 learners were equipped with strong lexical inferring strategies, a belief strongly supported by other vocabulary researchers such as Nation (2005). Learners need to be encouraged to acquire semantic knowledge at the sentence and paragraph level as well as domain, discipline and thematic content knowledge in order to be able to infer meanings of new words encountered. Developing semantic and thematic knowledge of content requires learners to be

equipped with a range of inferencing strategies. The findings suggest that L2 learners should be encouraged to focus attention not only on meanings or definitions of new words encountered in reading texts but also on their forms. Learners should also be made aware of the advantages of inferencing as a strategy through available contextual clues and knowledge of lexical density of texts. At university and in tertiary learning environments, L2 learners encountering low frequency words need to apply vocabulary strategies that are effectual. Hence a keen awareness of lexical and inferencing strategies are essential in L2 learners. Given that many L2 learners' achievements at a tertiary level of education depends largely in part on their ability to comprehend while reading, it is necessary to provide instruction that equips L2 learners with the lexical learning skills and inferencing strategies needed for lifelong vocabulary development. L2 learners may require instruction that sustains independent word-learning strategies to direct students on how to be able to ascertain the meanings of unknown words.

Further, through verbal protocols gathered, participants recounted how they used a range of strategies such as guessing from context, checking meanings with peers to confirm meanings of words at sentence and context levels. Learners benefited from consulting both monolingual and bilingual dictionaries as a strategy for finding meaning of words, or for confirming meanings of words gained through guessing from context, or through consulting peers. This knowledge is consistent with research evidence from studies conducted (Knight, 1994) on the efficacy of consulting dictionaries. Pedagogical implications from the study call for more specific instruction to be given to learners for developing strategies for enhanced vocabulary production. Increased awareness in L2 learners of available transfer of cognates from L1 through strategy practice is warranted through the research findings. Verbal protocol evidence from participants in the study supports benefits of transfer techniques that they applied for gaining word production.

The study recommends that learners be made aware of the various vocabulary learning strategies such as meta-cognitive, cognitive, memory and social strategies for vocabulary learning including new vocabulary learning strategies

discovered through the present study. Strategies such as using contextual clues, methods of contextual encoding, focussing on word forms and consulting dictionaries in particular could be prompted among L2 learners during class activities. Moreover L2 learners need to know that there are inferencing strategies they may apply for deduction and linguistic transfer of information from L1 cognates. This information could be used by instructors and designers of vocabulary learning tasks to teach learners that awareness of learner mental processes, existing vocabulary strategies, new lexical strategies, models of representation, and that active practice and evaluation of vocabulary strategies assist L2 learners in developing productive vocabulary proficiency.

7.1.2 Developing Capability of Vocabulary Instructors

The study highlights that it is vital for instructors to be equipped with the skills needed to implement successful vocabulary inferencing strategy instruction in L2 classrooms. The findings suggest that engaging L2 learners through focussed vocabulary learning activities is essential for vocabulary development. It is plausible that not all instructors have the skills to incorporate effectual vocabulary learning strategies in their classrooms. The findings tend to support the fact that merely teaching discrete vocabulary to the L2 learners do not lead to successful word production and more context based and result oriented learning activities need to be implemented in the L2 classrooms. Many L2 language classes focus on teaching word lists and discrete vocabulary which do not seem to advantage L2 learners in academic tertiary settings. Language instruction should prepare learners to use a variety of individual approaches for their vocabulary learning tasks. Brief explanations of vocabulary learning processes and examples of lexical strategy use could be provided to the learners prior to instruction. An analysis of L2 learner vocabulary needs could be conducted by the instructors so that L2 learners may develop vocabulary required in tertiary education.

Additionally, instructors may be made aware of the rationale for using specific instruction while developing lexical strategies in learners. It is important for

L2 instructors and facilitators to develop better understanding of L2 learners' vocabulary learning processes so that they are able to adapt or create instructional materials to suit L2 learners in their classrooms. The needs of specific groups and levels of L2 learners should be considered before vocabulary learning curricula are developed so that pertinent vocabulary learning tasks can be integrated in their learning activities.

A vocabulary needs analysis of the L2 learners should be taken into account by instructors so that the corresponding tasks created will enable L2 learners to adapt learning strategies for interacting with the linguistic resources to resolve any vocabulary inadequacies. Knowledge of student learning styles may assist in identifying which vocabulary learning strategy is best suited to the L2 learners. The findings suggest that prior vocabulary knowledge of L2 learners (pre-receptive vocabulary proficiency) and learners' cultural background, could impact the way in which L2 learners selected appropriate vocabulary learning strategies.

Universities and institutions should be encouraged to provide vocabulary strategy training programmes to language instructors so that instructors understand how to instil effective vocabulary training techniques in their students. It is important that instructors/ language facilitators continuously upgrade their skills through attending requisite training programmes that have been informed through valid research studies on L2 vocabulary/ language learning, and be strongly encouraged to include in their teaching a motivational framework of vocabulary learning to their students. Thus training language instructors to better equip L2 students with the lexical strategy skills needed is desirable.

The study participants who received explicit instruction in vocabulary learning and strategies over a time frame of one semester demonstrated better vocabulary proficiency. Therefore it is plausible to suggest that vocabulary learning instruction related to teaching vocabulary learning techniques or strategies be extended to longer periods of teaching time extending to at least 12 weeks duration. Currently, there is insufficient research to guide teachers on how much time is spent

on strategy training (Nation, 2001). The study has demonstrated the efficacy of integrating vocabulary learning activities into academic curriculum for a minimum duration of 12 weeks.

7.1.3 Opportunities for Word Production

The study highlighted that providing opportunities in the classroom for word production facilitated L2 vocabulary learning. In verbal reports L2 learners stated that they considered new words encountered to be part of their mental lexicons only when they began to use the words in their own writing and speech. This fact suggests that integrating usage of low frequency words in class room activities advances long term retention of words, which in turn may lead to productive vocabulary development. The findings suggest that increasing frequency of exposure to new lexical components positively influenced vocabulary production. From an instructional standpoint, one of the implications of this finding is that it is essential to provide vocabulary learners with opportunities to attempt vocabulary production during vocabulary learning activities. In tertiary learning realms, it is necessary for L2 learners to acquire a large number of words as well as be proficient with meanings of related technical words. Through providing activities that would develop word consciousness in L2 learners instructors are able to contribute to knowledge of word usage such as if they are idioms or metaphors etc.

Although vocabulary researchers have not come to agreement about how many times a new word needs to be encountered or used for successful word production, studies (Nation, 1990; Henriksen 1999) show that through multiple exposures to low frequency words, and through developing competencies from partial recognitions of words to precise knowledge of words, L2 learners could enhance their word productive capacity. The findings from the study seem to confirm the above notion, as illustrated by participants in the study who received explicit instruction and

encouragement in word productive activities, and through demonstrated advancements in vocabulary production. Verbal protocol analysis from the study also point out to positive signalling for word productive activities. Learners stated that the attention given to new words helped them to focus on acquiring meaning through supporting activities in classrooms and also through interaction with peers. There is an understanding that L2 learners must be able to use collocations well in their writing and speech to be graded on a level with native speakers.

Pedagogically, the findings imply that instructors need to create varied word production tasks to assist L2 learners to convert low frequency words to become part of their mental lexicon. For instance, instructors could create vocabulary tasks where learners are required to construct sentences using low frequency words in academic writing activities which may assist in better retention of new words encountered in texts. The study reiterates that L2 learners should be provided with opportunities to use new words encountered in contexts through proficient task designs, as multiple usage of vocabulary encourages vocabulary production. Instructors should be encouraged to provide explicit instruction of new words with low frequency (recognised from texts with higher lexical density) identified by L2 learners through providing definitions and examples of usage.

7.1.4 Encouraging Reading

As it is not possible to teach large number of words through direct instruction, L2 learners should be persuaded to read more and encouraged to have exposure to low frequency words as much as possible through reading. In tertiary learning settings, teaching word learning strategies should include the ability to use contextual clues and being conscious of word forms and associations from domain and discipline reading. From the study it appears that vocabulary can be acquired progressively from single exposures of words to multiple exposures and usage.

Multiple exposures to words through reading contributed to L2 learners' understanding of word meaning as reported by L2 learners in phase one of the study. In this setting L2 learners particularly referred to academic reading contexts. Clearly positive associations were developed from contextual, technical and background meaning during reading by L2 learners to move from pre-receptive vocabulary proficiency, through to recognition of words, formation of words in mental lexicon, to productive processes through deployment of appropriate lexical use. Therefore multiple encounters of low frequency words through wide reading practices and in specific disciplines and domains should be encouraged to increase L2 learners' technical vocabulary knowledge.

The emergent pre-receptive- productive (PR-PV) L2 vocabulary development model from the study highlights the various stages that occur in the L2 learner's meta-cognitive schemata and vocabulary development. It appears that when learners encountered new words in texts they attempted lexical access for new words encountered and the resultant processes that transpired led to how successful the learners were in converting previously unknown words into productive vocabulary. When learners failed in their attempt to connect to lexical access they turned to vocabulary inferencing strategies as reported by participants in the study.

The meaning constructional processes used by L2 learners relied on a range of knowledge. Domain knowledge or background knowledge was cited as particularly useful in developing strong connections to meaning. Lexical positioning allowed L2 learners to assess knowledge in hand and check for corresponding schemata in their established L1 or in the developing L2 which in this case is English. As some participants stated, lexically dense reading delayed word production mainly due to their lack of knowledge of technical or discipline vocabulary. Despite the challenges presented during reading lexically dense texts, the findings suggest that in order for L2 learners to progress with comprehension and meaning construction, they should be given increased reading opportunities for developing larger vocabularies. L2 learners of English should be encouraged to have a greater awareness of word consciousness and of how words are connected to contexts. In addition to providing

exposure to a range of new and unfamiliar words, reading extensively adds to vocabulary growth through offering L2 learners opportunities to make connections with word families among familiar words and unfamiliar but semantically related words.

The L2 learners from tertiary backgrounds are required to refer to journal articles and texts dealing with technical vocabulary and need to develop technical vocabulary knowledge for successful lexical access. The need for paraphrasing and citing from academic and domain specific fields was integral to their academic success as whole. The pedagogical implication from the study is that L2 learners should be encouraged to read widely in academic disciplines to develop a larger pool of technical vocabulary through supportive learning activities.

7.1.5 Encouraging Social Learning/ Peer Learning

The study highlights how L2 learners are situated in specific social and cultural contexts which place emphasis on constructivist learning environments. From the verbal protocols gathered in the study, it is clear that peer learning and social learning is desirable among L2 vocabulary learners. Participants related how consulting peers perceived as more knowledgeable assisted them in better comprehension during reading activities and for developing meaning. It is plausible to assume that participants benefited from engaging with more knowledgeable peers. At least the practice of consulting with more knowledgeable peers assisted L2 learners to confirm meanings they guessed through transfer and translation from L1. Instructors should therefore initiate settings in the classroom that encourage social interactions with more knowledgeable peers.

Cooperative learning opportunities in which L2 learners worked in pairs or in groups had clearly advanced vocabulary production. Constructivist theories such as co-constructivism (Brooks & Brooks, 1993) espouse that knowledge construction is a socio-linguistic process that is dependent on the content and culture where it occurs.

Therefore vocabulary knowledge can be created through meaningful interactions with peers and instructors and through negotiation. Co-constructivism further encourages learners to engage in argumentation and reflection to refine knowledge gain. In multi-cultural, tertiary backgrounds, L2 learners could be motivated to use numerous perspectives to construct meaning. In this respect, the role of the L2 learners is essential and instructors must present vocabulary learning in wider socio-cultural contexts in which comprehension and meaning is produced through the collective knowledge and interactions of the groups of learners. Instructors should encourage peer-learning and social learning environments in L2 learners to increase and advance vocabulary proficiency.

Meanings of low frequency words could be discussed in the classroom to expose L2 learners to a wide variety of interpretations arrived at by the learners themselves. The study illustrated that L2 learners are motivated to acquire new vocabulary and were cognisant of the opportunities available to them through active engagement with other learners. This fact should prompt programme developers, instructors, and instructional designers to develop vocabulary development tasks to reflect learners' social identities such as linguistic backgrounds, interests, and learning aims. Vocabulary instruction and learning should allow for a variety of activities and tasks that learners can select for participation with peers which encourage vocabulary production.

7.1.6 Encouraging Meta-cognitive Learning Strategies

The findings of this study appear to indicate that explicit meta-cognitive strategy instruction has a positive impact on the lexical knowledge development of L2 students. The study suggests that both content and context play significant roles in the extent to which L2 learners interact efficiently with the reading texts. In order for L2 learners to connect with the lexical choices presented through schematic knowledge, instructors must raise awareness of these lexical choices so that the schema can be constructed in the mental lexicon. As meta-cognitive strategies involve knowledge about learning and control over learning, it would benefit L2 learners if they are made

aware of them. Vocabulary learning strategies should be presented continuously to L2 learners and adequate practice of these strategies recommended till these strategies can gradually be developed into procedural knowledge. The participants from phase one of the study were found to employ a range of meta-cognitive strategies in their efforts to increase vocabulary production and learning such as text-processing in which they were able to notice unfamiliar words and focus on word forms and meanings.

Another meta-cognitive strategy employed by study participants was limited processing capacity where the participants skimmed over words they perceived as not significant to their understanding of text. Participants also appeared to retain meanings of words depending on their perception of need which is a meta-cognitive strategy. The pedagogical implications of these findings are that when L2 learners are aware of meta-cognitive strategies for learning vocabulary, they would be able to select the strategies suitable for developing vocabulary. At the same time the study highlights the need for systematic attention to be paid to explicit instruction of lexical and inferencing strategies for vocabulary development to occur in L2 learners.

Effective meta-cognitive strategies to deal with low frequency words encountered in lexically dense texts should be made available to learners. There is a need for learners to develop strategies directly related to the task and context that they navigate as in order to convert new words to become part of their mental lexicon they must create lexical associations that are effective. Through awareness of meta-cognitive learning strategies, L2 learners may be able to take direction for their vocabulary learning processes and make informed choices regarding their vocabulary study plans. The study has confirmed beliefs that encouraging meta-cognitive awareness of lexical strategies in L2 learners through direct instruction and modelling strategy use for L2 learners is beneficial for developing vocabulary proficiency.

7.1.7 Vocabulary Learning Objectives and Goals

L2 learners in academic tertiary settings should be informed of the goals of vocabulary learning/ inferencing strategies and be made aware of the rationale for the teaching of strategies. This knowledge may motivate them in developing new strategies and skills suited to tasks and encourage the development and growth of lexical inferencing strategies. Adult learning theories emphasise that adults learn best when the knowledge presented to them have immediate value. Therefore vocabulary instruction in tertiary realms should inform L2 learners about the objectives of lexical learning strategies. Instructors should also encourage L2 learners to monitor and review inferencing strategy skills for effectiveness. During word production processes either in writing or during speech, the L2 learners need to convert lexical intentions or plans into mental representations that would facilitate clear expression of thoughts and meaning even while paying attention to aspects such as cohesion, spelling and the audience level intended for the lexical production process. These are complex activities that necessitate L2 learners to develop advanced skills in the L2 language. The findings therefore advocate the teaching of goals and objectives as L2 learners in the study have benefited from sharing of objectives for using vocabulary learning strategies.

The findings of the study suggest that presenting clear objectives for vocabulary development learning tasks may help motivate L2 learners to approach their learning with more attentiveness. The aspects of inferencing strategy instruction should include not only explanations of the strategies and their functions, but also modelling the use of strategy by the instructor, and guided practice of strategies matched to tasks and contexts. The implication is that through the sharing of goals and objectives of lexical inferencing strategies, it is possible not only to impart to L2 learners the characteristics and usefulness of the strategies taught in the classroom but also to encourage them to understand the effectiveness of the usage of strategies.

7.1.8 The Use of Search Engines in learning vocabulary

One of the new strategies or variant strategies identified through the study is the preference of L2 learners to rely upon search engines like 'google' to check for meanings and to confirm meanings. Previous research conducted on vocabulary development in L2 learners had not specifically reported the use of 'google' as a source for confirming meanings or clarifying concepts as recounted by participants in phase one of the study. The verbal protocol analysis indicated that dictionary type referral strategies through use of internet resources and search engines such as 'google' were used by the current L2 learners in concurrence with other strategies to gain a more holistic knowledge of reading texts. The predilection for L2 learners for referring to internet resources for meaning construction and for possible comprehension solutions emphasise the increased reliance by current L2 learners on technological tools for learning vocabulary. The pedagogical implication of this finding is that language instructors could take advantage of this information and encourage in L2 learners to triangulate word meanings they learn through the use of technology and search engines through consultation with more resources. Concurrently L2 learners should be reminded to use guidelines for verifying knowledge sources for reliability and credibility. The inclination of L2 learners for using search engines for advancing lexical knowledge is practical information that designers of vocabulary learning curricula could use to propose reading texts that link to learning tasks via internet resources to be incorporated by language teachers as learning activities for vocabulary advancement in learners.

The findings also point out to the ease of navigation in cyber space for language and vocabulary learning by the 'net-savvy' generation of L2 learners. Consequently, in the context of tertiary education, it is important to ensure that L2 learners have sufficient access to online resources and that vocabulary instructors take advantage of the study approaches of L2 learners to ensure that learning tasks are compatible with learner preferences.

7.1.9 Readability Measures in Reading Texts

The study has highlighted that for developing vocabulary proficiency in L2 learners it is significant to introduce learners to reading texts that have adequate frequency range, readability and lexical density. Contrary to the assumption that for building fluency learners with lower language proficiency need to read texts that include little or no unfamiliar vocabulary (Nation, 2001), the present study on tertiary L2 learners has demonstrated that reading comprehension texts introduced to L2 learners must include valid content, lexical knowledge, lexical density, and readability appropriate to domains of learning that learners are accustomed to in their academic learning activities. It is desirable to select reading texts related to learners' discipline while setting relevant learning tasks so that learners are motivated to acquire words deemed as significant by the discipline. While the optimal readability range for a reading text is between the range of 60-70, it is important to introduce to L2 learners texts with lower readability ranges that have higher degrees of difficulty. The findings suggest that it is beneficial to introduce to L2 learners texts with lexical density appropriate to the study discipline so that through frequent practice and familiarity with texts with varying degrees of difficulties L2 learners may develop breadth of vocabulary knowledge. In other words, for L2 learners to benefit from extensive reading it is important that they read for specific purposes and also read texts that have various difficulty levels.

The CRT-achievement test results in control group participants showed that it is possible for L2 learners to develop depth of vocabulary through exposure to varying readability ranges in texts and through frequent contact with content words in reading texts. Presumably it is not inconceivable that when the tertiary L2 learners are at an advanced phase of learning the different types of texts do provide them with the chance for developing vocabulary through inferencing strategies taught to them. The study has shown that it is important to widen the lexical contact of L2 learners with the technical vocabulary and academic vocabulary they require for achieving the proficiency required for their academic writing needs. In order to encourage L2 learners' knowledge of technical vocabulary, instructors must select reading texts

with the appropriate level of readability and lexical density so that lexical associations may be developed and accrued in their mental lexicons.

7.2 Theoretical Implications

The findings from the study, then, reveal that L2 vocabulary development occurs when learners employ diverse inferencing strategies and engage in social realms of learning, or in other words, work with peers and instructors to develop vocabulary. The findings appear to confirm that L2 learners select lexical or inferencing strategies depending on the semantic, syntactic, morphological and formal clues available in a reading context. The findings tend to indicate that one way in which L2 learners develop vocabulary is through schemata as outlined in schema theory (Rumelhart, 1977; Goodman, 1984; Steffenson & Joag-Dev, 1984). During reading, L2 learners utilised both the systemic level and schematic levels of language to discern contextual clues. The systemic level included phonological, morphological and syntactic elements and the schematic level included background knowledge in relation to the strategies L2 learners selected. These facts were confirmed through data gathered through verbal protocols from the study. Theoretically, comprehension and word production are corresponding phenomena in a learner's mental lexicon development, however it is acknowledged that differences can occur according to the L2 learners' vocabulary proficiency.

Researchers indicated that (Vollmer & Sang, 1983) greater knowledge of syntax is required in production than in comprehension which suggests how language is received and produced are not exactly similar. The study endorses the belief that pre-receptive to productive stages of vocabulary production are negotiated by L2 learners through conscious processes, based on their textual knowledge which encompasses semantic, syntactic, and morphological knowledge and through corresponding learning goals. In understanding a text, L2 learners used interpretive processes for achieving matches between schematic knowledge and encoded language systemically, a process which is linked to textual connectivity. From the verbal

protocol in the study, it was found that during reading, tertiary L2 learner participants in the study referred to two types of prior knowledge, content schema of a topic and formal schema from engineering and technical disciplines to construct meaning of texts, and also referred to socio-cultural knowledge. A schema embodies a network of knowledge related to a word (Nagy & Scott, 1990). As word schemas involve both semantic knowledge about the connections of word meanings to precise concepts and linguistic knowledge about words, such as their roots and their relationships to other words with the same roots, it is important that L2 learners develop a deep awareness of the way in which their knowledge of words are connected.

This study is aligned to the notion that vocabulary development necessitates L2 learners to actively construct meaning through awareness of inferencing strategies, contexts and awareness of the mental lexicon. The study further highlights that vocabulary development is an interactive process through which L2 learners consciously employ inferencing strategies, and communicate and collaborate with other L2 learners and their facilitators in a constructive learning environment, to advance vocabulary in mental lexicons. The study emphasises the use of schematic and contextual knowledge and believes that vocabulary development for L2 learners is bounded by cognitive constraints and successful inferencing requires learners to overcome these constraints. Increased linguistic and lexical knowledge seemed to provide L2 learners with more details to advance their development of productive vocabulary. The study highlights that although, L2 learners must learn to deal with selection of suitable strategies for inferencing, essentially the way in which they manage the selection processes ascertained the pathways to efficient synthesis and production of meaning. The inferencing strategies utilised by the L2 learners determined how successful they would be with comprehension and meaning construction.

The findings from the study appear to verify that L2 learners begin vocabulary advancement by recognising and learning meanings of new words encountered, and constructing a representation of meaning in academic and discipline contexts. In this respect, this finding has associations with connectionism, as

connectionism views linguistic knowledge to be integrated with academic knowledge leading to productive vocabulary. The study points out that interaction, both formal and informal with peers and instructors assisted in productive vocabulary as evidenced in verbal protocol summaries. Interaction, a concept that is well established in language research (Ellis, 1999) seems to be in progress during vocabulary development from pre- receptive to productive levels. It was evident that L2 vocabulary learners benefited from social constructivist environments where interaction occurred between peers and between peers and facilitators. Results of findings from phase two of the study confirm that formal and explicit instruction of vocabulary learning strategies may be more effective than informal interactions with peers and instructors. In this regard, the findings conform to learnability theory principles advocated by Pinker (2000) which underscore the learning environment and strategies required to achieve the target language which in this case is English.

7.3 Recommendations for Further Research

There are some issues related to the present study that emerged during the process of this research that could benefit from further research studies.

The study did not investigate how the participants in the experimental groups who were explicitly taught vocabulary learning/ inferencing strategies specifically used the strategies to further develop their vocabulary proficiency. The results from Phase Two of the study showed the incremental gains made by participants in the experimental groups and provided data on the performance of the experimental groups on the individual lexical items in the criterion-referenced (CRT) achievement tests. A comparison of the results on individual items in the CRT-achievement tests from both control and experimental groups showed both percentage gains and the lexical items on which the experimental group participants had scored much better than control group participants. However, the results from Phase Two do not inform *how* and *which* vocabulary learning / inferencing strategies had been used specifically to develop vocabulary proficiency in specific contexts. A further study to

assess the usage of vocabulary learning and inferencing strategies by tertiary L2 learners after explicit teaching of strategies would shed more light on those processes. The study could focus on which strategy is applied for a specific vocabulary need.

Further investigations on vocabulary development patterns in tertiary L2 learners with L1 other than Chinese/ Malay should be conducted to study comparative differences. It would be interesting to compare vocabulary development patterns in tertiary L2 learners with L1 cognates that are similar to English. The findings from such studies would benefit facilitators and instructors as currently international tertiary second language education draws students from multi-lingual backgrounds creating opportunities for increased interaction and learning.

Studies on how L2 vocabulary instructors could benefit from receiving training in teaching vocabulary strategies should be conducted. There is a need for instructors to be trained in vocabulary enrichment activities for tertiary and technical studies and with procedures for effective paraphrasing and editing of writing for academic essays and technical reports. Currently there is insufficient data on results from studies on how training should be conducted for vocabulary instructors specifically in L2 English learning environments as most studies have concentrated on training for second language learning in languages other than English.

7.4 Concluding Notes

The primary intention of this thesis was to explain the patterns of English vocabulary inferencing strategies in L2 learners occurring between pre-receptive stages to productive processes for vocabulary development in pedagogical contexts and examine the effectiveness of meditational instruction of inferencing, and vocabulary learning strategies to advance vocabulary development. It is hoped that the pedagogical and theoretical implications arising from the findings would enable researchers in furthering research on vocabulary production processes. Continuous

efforts should be taken by language instructors to raise awareness in learners on approaches for vocabulary learning and skill building. Helping learners to take note of new words is significant as well as helping them to see words as lexis. This means that learners need to focus on phrases, groups of words that combine to form semi-phrases and collocations. The instructors need to encourage awareness of most frequently used lexical combinations in specific disciplines for learners to achieve productive vocabulary. Contextualisation of word combinations is another way to assist learners with tools for organising information and to generate word production. It is undeniable that considerable attention needs to be allocated for the development of vocabulary knowledge in L2 learners.

Prominent second language acquisition theories applied in the thesis highlighted the complex subtleties involved in the comprehension of lexical knowledge by L2 learners. As vocabulary is strong indicator of productive language skills and demonstrates whether L2 learners in tertiary settings are able to present their views analytically and possess standards expected of them by the academic discourse community, it is vital that supportive assistance be provided to L2 learners to develop the vocabulary proficiency required in a course through self-access centres and by language facilitors. The findings of this study highlight that L2 vocabulary development is a complex phenomenon that needs to consider carefully the inferencing strategies of adult L2 learners and the role of context in reading. The constructivist peer learning environment in tertiary learning environments provided the learners with opportunities to engage in vocabulary production activities. The findings have highlighted how L2 vocabulary development is influenced by the capacity of the learners to use a number of effective inferencing strategies and the ability to form mental associations through available contextual references. The study has confirmed that vocabulary production involves breadth of vocabulary knowledge and depth of vocabulary knowledge and the availability of the mental lexicon for comprehension and formation of productive vocabulary.

The study has drawn attention to the role that context plays in comprehension and vocabulary production and justified explicit instructional

mediation in L2 vocabulary learning. The findings from the study underscore the need for instructors to provide clear objectives and learning goals for vocabulary development to occur in learners. Developing in L2 learners increased awareness on available contextual clues depending on the lexical density of reading texts through modelling and illustrations assist vocabulary production. The study is in congruence with the fact that for developing mental lexicons L2 learners use morphological, syntactical and semantic links.

Understanding the patterns through which L2 learners convert pre-receptive vocabulary into productive vocabulary assist language facilitators to teach effective inferencing and vocabulary learning strategies to help create in learners accurate lexical associations that achieves the process of vocabulary production. The study has provided valid and precise understanding regarding L2 learners' vocabulary developmental processes occurring during reading. It had provided in-depth knowledge on the various inferencing strategies utilised comprising of memory, cognitive, meta-cognitive and social strategies and also illuminated the ways in which mental lexicons are developed through the verbal protocol analysis gathered in the study.

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