University of Alberta

An Investigation into the Use and Benefits of Assistive Technologies for English as a Second Language Users' Literacy Development.

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Education
In
Technology in Education

Department of Educational Psychology

Fall 2011
Edmonton, Alberta

Abstract

This investigation uses the quasi experimental one group pretest-posttest research design to identify vocabulary learning strategies specific to an International Practical Nurse Diploma program, at a western college in Canada. Vocabulary Learning Strategies proposed by Oxford (1990) and the Overlapping Waves Theory by Siegler (1996) will be applied to identify the cognitive development of the students. This cognitive analysis is based on creating a Universally Designed educational environment which will accommodate individuals with a wide range of abilities and disabilities by reducing barriers (Rose, Hasselbring, Stahi, & Zabala, 2005). Based on this principle, the investigation used Assistive Technologies to support college students' English Language development focusing on vocabulary. This strategy could provide a link for struggling students by minimizing frustrations while providing constant feedback (Sorrell, Bell & McCallum, 2007). The objectives of this research are to: a) develop strategy support through the use of an Assistive Technology that introduce students to key programs which will familiarize them with the features of the Read & Write Gold program, and b) to identify relationships between student strategy choices (features or prior strategies) and intervention effectiveness. Technological supports need to be researched further too continually grow and develop programs to meet the current needs of students and employers alike.

Acknowledgements

I would like to express my profound gratitude to the students who participated in this study and give their time in this research. These participants provide insight into their learning journeys in language acquisition by sharing strategies and frustrations. Without their active participation this study would have not been possible.

I would also like to thank my supervisor, Dr. Patricia Boechler, whose guidance and support were instrumental in the completion of this thesis and my master's program. Every time we had a discussion I felt more focused and encouraged to keep working towards my goal. Thank you! I am very grateful for each of my professors who shared their personal experiences and support. Also, thank you to my committee members, Dr. Catherine Adams and Dr. Veronica Smith.

Thank you to my family and friends who have provided support, encouragement, love, and understanding throughout this process. To all of my editors who read and reread this document and provided insight into the objectiveness especially Flo Brokop. Finally, to my partner who is an important part of my life and integral in completing this endeavor. You have followed me, carried me and stood beside me, thank you for supporting me as I follow my dreams.

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CHAPTER ONE

Introduction

Strategy use and computer assisted learning have been separately researched since the 1970's, specifically with respect to language acquisition (Lancia, 2004 & Sanaoui, 1995). Both of these learning supports have affected the development and delivery of language courses at all levels. Adult English as Second Language (ESL) students have been shown to require specific support in order to achieve success in post-secondary education (Sanaoui, 1995). Due to specific learner outcomes, this student population brings a unique skill set to the classroom, with a noticeably high level of motivation to succeed at lexical acquisition in their specific program area (Lessard-Clouston, 1994). This study has utilized the high motivation of ESL adult learners to understand the impact of text-to-speech (TTS) computer support on participants' strategic choice for lexical acquisition.

This chapter provides a brief background of prior research to identify strategy use for vocabulary development and technology used to assist with language acquisition. It describes the research problem, study purpose, research questions, and study significance and limitations. A list of common terms is provided, as well as an organizational outline for the rest of the study.

Background to the Study

There is no prior research examining the combined areas of language strategy use with strategic choice usage by ESL adult learners when supported by a TTS software computer assist feature. It was therefore imperative to separately examine these background areas identified previously in order to frame this study. A brief examination of the different strategies used to assist ESL learners will be presented. The principals of Universal Design (UD) will be the framework to create an accessible environment in which technology features will be taught. This

has been explored further in the literature review (Chapter Two) but is mentioned here in order to ground this study.

Language Learning Strategies

Language learning strategies have been identified in both fields of second language acquisition and cognitive psychology. First, language learning strategies have been used to understand how successful learners acquire the skills needed to learn a new language (Ruutmets, 1995). One of the most often referenced author in this area is Oxford (1990) who described, "specific actions taken by the learner to make learning easier, faster, more enjoyable, more self directed, more effective, and more transferable to new situations" (p. 8). Oxford identified a classification scheme to distinguish two broad categories of learning strategies (direct and indirect) that are implemented in education. Direct strategies are any strategies that directly involve the language being learned (Hsiao & Oxford, 2002). Examples include using a dictionary, mnemonic device, flash cards, or other techniques that can support lexical development. Indirect strategies are subdivided into metacognitive, affective, and social categories (Hsiao & Oxford, 2002). These strategies are often experienced and developed beyond the classroom to assist in cultural awareness and daily activities. The information-processing model is the framework for Oxford's language learning strategies.

The Overlapping Waves Theory

Numerous developmental psychologists have attempted to explain cognitive development, from the Gestalt psychology of Max Wertheimer, Wolfgang Köhler, and Kurt Koffka, to Jean Piaget and others after (Lefrancois, 2006). It is easier to observe and identify cognitive development in children and adolescents through changes in their behavior. Relevant to this study, the principles that govern cognitive development in children and adolescents have

also been applied to cognitive changes in adults (Butler & MacManus, 2000). These theoretical principles have been applied to adult learning acquisition through the identification of cognitive changes. Siegler (1981) proposed the idea of the microgenetics method that outlines how cognitive research can be conducted to understand learning. The microgenetic approach is a method in which frequent, repeated observation of a learner attempting a new skill is used to understand the course of change that happens just prior to complete learning. This has led to the development of the Overlapping Waves Theory and research to verify the concept that a learner moves between three or four different strategies to reach the desired outcome (Siegler & Svetina, 2002). According to Siegler (1996), "cognitive development can be more accurately characterized by a pattern of overlapping waves that represent developmental trajectories of adaptive strategy use," (Sharp, Sinatra, & Reynolds, 2008, p. 206). This method and theory follows the framework of Vygotsky's theory of metacognition, including planning and monitoring one's learning to increase independent learning (Hsiao & Oxford, 2002). The Overlapping Waves Theory provides the structure to understand how new sophisticated strategies are added to a student's repertoire and how their strategy choice help to increase their lexical understanding.

Assistive Technology: Read & Write Gold

There is limited research in the area of Assistive Technology (AT) used to assist in the development of ESL language, although the use of a Computer-Assisted Language Learning (CALL) system to understand ESL student computer experience has been examined. CALL is defined as a computer that can improve language acquisition through individual practice activities (Gallardo del Puerto & Gamboa, 2009). CALL provides activities that focus on rote memory and identification of words. This provides students the opportunity to practice, but does

not teach them how to transfer their language knowledge (Gallardo del Puerto & Gamboa, 2009). AT technologies provide different features that can be customized to the students' individual needs. By providing a computer program that has built in modification, the needs of more students can be met. The program that has been used in this research is called 'Read & Write Gold.' This program has many different features that support reading, writing and researching on most computer programs and internet sites (textHelp, 2010). One of the key features that has been proven useful for struggling readers in research is the use of text-to-speech (Edyburn, 2007). This function reads the words aloud, allowing the reader to hear entire sentences, paragraphs and documents. "One type of technology development to overcome these students' reading problems are computer programs that provide synthetic speech output, synchronized with text (Kelemes, Epstein, Zuker, Grinber, & Ilovitch, 2006) such as text to speech software," (Phayer, 2010, p. 22).

Statement of the Problem

With community colleges increasing their capacity to serve more students, the increased student diversity is changing the environmental context. Although many colleges are reporting an increase in ESL student enrollment, no published research has examined the demand on individual supports that may result. Vocabulary strategies are not explicitly taught in many language classes, since "students are usually expected to learn vocabulary on their own without much guidance" (Oxford and Scarcella, 1994, p. 231). It is important for ESL instructors to help students understand their own approaches to vocabulary learning and provide alternative strategies when necessary. One area that utilizes scaffolds to support adult academic autonomy is special education in college programs (Lee & Templeton, 2008). Students need scaffolding support in the areas of self-determination, social skills strategies, accommodation and assistive

technology proficiency (Webb, Patterson, Syverud, & Seabrooks-Blackmore, 2008). Research has indicated that creating an inclusive, Universal Design (UD) environment will accommodate individuals with a wide range of abilities and disabilities by reducing barriers (Rose et al, 2005). By intertwining vocabulary development with current assistive technologies, ESL learners can be taught direct technological TTS vocabulary strategies which could support the Overlapping Waves Theory. It has not been reported if AT provided in a UD environment supports vocabulary learning for college ESL students.

Purpose of the Study

The purpose of this study is to determine if Adult ESL learners will use R&WG as a vocabulary learning strategies in the Practical Nurse International Program (PNIP) at Western Canadian College. It is hypothesized that by providing extra assistive technology strategy sessions, students will gain technology support in reading medical academic journals. To understand vocabulary development, Oxford's (1990) vocabulary classification system of information processing will be used in conjunction with Siegler's (1996) Overlapping Waves Theory will confirm the cognitive changes due to learning new technologically supported strategies. The purpose of this study was to investigate the strategic choices for vocabulary development made by adult ESL learners in a universally designed academic program. The objectives of this research study were to:

a) Develop strategy support through the use of an AT that introduces students to key programs which will familiarize them with the features of the 'Read & Write Gold' program at a College, and
b) To identify relationships between student strategy choices (features or prior strategies) and intervention effectiveness.

It is anticipated that the data collected for this study will provide evidence of individual strategy use.

Research Questions

By establishing and creating a UD educational environment, this quasi-experiment one-group pretest-posttest design, will investigate the effects of using literacy support features available through a software program called Read & Write Gold, the questions are:

What strategies are used by ESL students to build vocabulary?

Does the use of R&WG increase ESL students' vocabulary?

Specifically, does the TTS feature assist in student lexical acquisition?

Significance of the Study

Study findings will contribute new insight into the merging of special education research with ESL research in the post-secondary environment. Educational technologies, specifically assistive technologies, can provide verification of existing strategy supports in the areas of vocabulary. With an increasingly diverse ESL student population, community colleges must explore collaborative student supports and apply research findings to different populations. This can extend instructional scaffolds to language acquisition through vocabulary development. Results from this study will inform the design and delivery of content-specific ESL course delivery to increase student retention. Additionally, the study will provide a platform for faculty communication about the appropriate application of universal design principles, which may challenge professionals to examine their current attitudes and beliefs.

Theoretical Framework

The psychological perspectives used in this study to understand participants' strategic choices include information processing and metacognitive awareness. As stated previously in

this chapter, information processing will follow Oxford's (1990) direct and indirect strategic lexical development model. As well this study will be supported by Seigler's (1996) Overlapping Waves Theory that examines individual cognitive approach to learning a new concept. This theory is based on the microgenetics method, in which participants' changes in behavior are repeatedly observed over a short period of time (Siegler & Svetina, 2002). It is stated that as an individual learns a new concept, they move between three or four different strategies to reach the desired outcome (Siegler & Svetina, 2002). Both of these frameworks together will be used in this study to understand the lexical development of adult ESL learners.

Delimitations and Limitations

The delimitations in this study are the boundaries identified by the program. Participants were registered in an English course, which is a requirement of the completion of the PNIP program. The researcher does not have any involvement in the requirements for the program or course. The researcher also does not have any role in the selection of course material or content delivery.

The study had the following limitations:

- The course content and course resources have been provided and copyrighted for the use College and program students.
- The PNIP program department outlined the course timeline and student timeframes for study session attendance.
- The sample of students was drawn from one possible class being conducted at the time of research.
- Many variables outside the control of the researcher could impact the students' involvement and attendance. These variables may include, but are not limited to:

personal and family issues, campus facilities, technology issues, program instructors, course completion, timeline changes, and student software access off campus.

Definitions of Terms

Definitions of terms used in this study, along with corresponding acronyms, are provided to facilitate reader clarity and prevent confusion:

1. Assistive technology (AT) - All devices that scaffold individual needs for students with disabilities to facilitate task completion (Dell, Newton, & Petroff, 2008; Johnston, Beard, & Bowden Carpenter, 2007; Martinez- Marrero & Estrada-Hernandez, 2008).
2. Canadian Language Benchmark (CLB) - A standardized test that has eight levels that assesses and ranks language acquisition in the areas of reading, reading comprehension, writing, and speaking (CLB, 2009).
3. Computer-Assisted Language Learning (CALL) - Any computer program that is used to assist in the acquisition of new language (Gallardo del Puerto & Gamboa, 2009).
4. Introduction to Composition (ENG) – A 3-credit course that focuses on essay composition and analysis.
5. English as a Second Language (ESL) - Self identified students whose primary language for communication is other than English (Boroch, Fillpot, Hope, & Johnstone, 2007).
6. Language Learners (LL) - Self identified students whose primary language is English but are limited to the academic vocabulary required (Gallardo del Puerto & Gamboa, 2009).
7. Practical Nurse International Program (PNIP) - A 19-month full-time program designed to support the internationally educated nursing professional to become licensed in Canada.

8. Read & Write Gold (R&WG) - A literacy software program that allows struggling students to access any curriculum and complete reading, writing, and research assignments independently (textHelp, 2010).
9. Text-to-Speech (TTS) - A computer software function that uses a synthesized voice to read aloud text from the computer screen (Phayer, 2010).
10. Universal Design (UD) - Architecture and design principles that increase accessibility for people with and without disabilities (Messinger-Willman & Marino, 2010).
11. Vocabulary Language Strategies (VLS) - Strategies used to support lexical development (Oxford, 1990, Sanaoui, 1992).

Study Organization

This research study is presented in five chapters. Chapter One included the background, statement of problem, purpose of the study, research questions, significance of the study, theoretical framework, delimitation and limitations, and definition of terms.

Chapter Two presents a literature review, including research in the areas of vocabulary learning strategies, assistive technology, reading supports, and post-secondary environments.,. Chapter Three describes the methodology in the following areas, research design, participants, materials, procedures and ethical considerations.

Chapter Four presents the results including descriptive statistics of all of the questionnaires administrated. Chapter Five provides a summary of the entire study, discussion of the findings, an additional analyses, and implications for practice, recommendations for further research, and a conclusion.

CHAPTER TWO

Literature Review

This literature review will provide the context of this study. As stated in Chapter One, the areas that will be explored are as follows: Vocabulary Learning Strategies (VLS), the Overlapping Waves Theory, and Assistive Technologies (AT) as a supportive aide within the post-secondary environment. First, the research conducted by Oxford (1990) will provide evidence in the area of ESL learners' lexical strategies. This will be supported by current research in the area that identifies different strategies that have been used to understand the information processing of students. Next, Seiglers' (1996) Overlapping Waves Theory will provide insight into the cognitive processes of how learners gain new strategies as well as move between strategies when learning new concepts. Current research will be explored to understand the cognitive impact that strategies have on learning. AT research in the area of special education describes strategic supports for struggling students. Within this section, empirical evidence will be provided to support the effectiveness of using TTS technology. Past computer programs also are identified in post-secondary institutions. Computer assisted language learning (CALL) will provide evidence into supports that ESL students have experienced in the classroom. This includes a discussion of CALL which has been widely used with ESL students in classrooms, as well as current post secondary structures.

The literature review will provide the framework for the main research question: Is there an identifiable connection between student strategy choices (AT features, prior academic strategies) and intervention effectiveness?

Vocabulary Learning Strategies and The Overlapping Waves Theory

The definition for a strategy in the Merriam-Webster's Dictionary (2011) is: a plan or an adaptation important for success. In this study, the use of strategies will be specific to the support adapted for the acquisition of language to ensure success. "Learning strategies are operations used by learning to aid the acquisition, storage, and retrieval of information," (Oxford & Nyikos, 1989, p. 291). To understand the different Vocabulary Language Strategies that students utilize, Oxford's taxonomy of Vocabulary Language Strategies (VLS) will be explored to provide the interrelationship between strategy use and lexical development. Next, to understand the cognitive decisions of strategy use, the Overlapping Waves Theory will be explored to identify learners strategy use (Siegler, 2004). To narrow the strategic variability in research and to explain how or why an individual moves between different strategies, both of these perspectives will be examined and explored in this section.

Vocabulary Learning Strategies

The effectives are of Vocabulary Learning Strategies (VLS) has been identified as a key skill for ESL student success. It can be supported in a variety of ways, depending on the background knowledge of faculty and the learning preferences of the student. Oxford, (1990) in her book entitled, Language Learning Strategies: What Every Teacher Should Know, lists the features of language learning strategies:

1. Contribute to the main goal, communicative competence.
2. Allow learners to become more self-directed.
3. Expand the role of teachers.
4. Are problem-oriented.
5. Are specific actions taken by the learners.
6. Involve many aspects of the learner, not just the cognitive.
7. Support learning both directly and indirectly.
8. Are not always observable.
9. Are often conscious.
10. Can be taught.
11. Are flexible.
12. Are influenced by a variety of factors. (Oxford, 1990, p. 9)

Many of these ideas listed by Oxford have been noted in research as best practices for instructors to use (Edyburn, 2010). Unfortunately, not all ESL instructors or faculty have had the opportunity to learn and practice these techniques; Oxford and Scarcella (1994) added that "students are usually expected to learn vocabulary on their own without much guidance" (p. 231). It is important for ESL instructors to be taught and supported in their own development of VLS and then assist students to develop their own understanding and approaches to vocabulary learning (Oxford & Scarcella, 1994). It has been said that:

> Good language learners use a variety of learning strategies, including cognitive strategies for associating new information with existing information in long-term memory and for forming and revising internal mental models; metacognition strategies for exercising " executive control" through planning, arranging, focusing, and evaluating their own learning process; social strategies for interacting with others and managing discourse; affective strategies for directing feeling, motivation, and attitudes related to learning; and compensation strategies (such as guessing unknown meaning while listening and reading, or using circumlocution in speaking and writing) for overcoming deficiencies in knowledge of the language. (Oxford & Nyikos, 1989, p. 291)

Good language learners can be viewed as good learners. Students that have the skills to transfer strategies to different content areas including language will increase their success by decreasing frustrations. More specifically, VLS can be a starting place for ESL students to build their independent academic autonomy. "Learning strategies are specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more

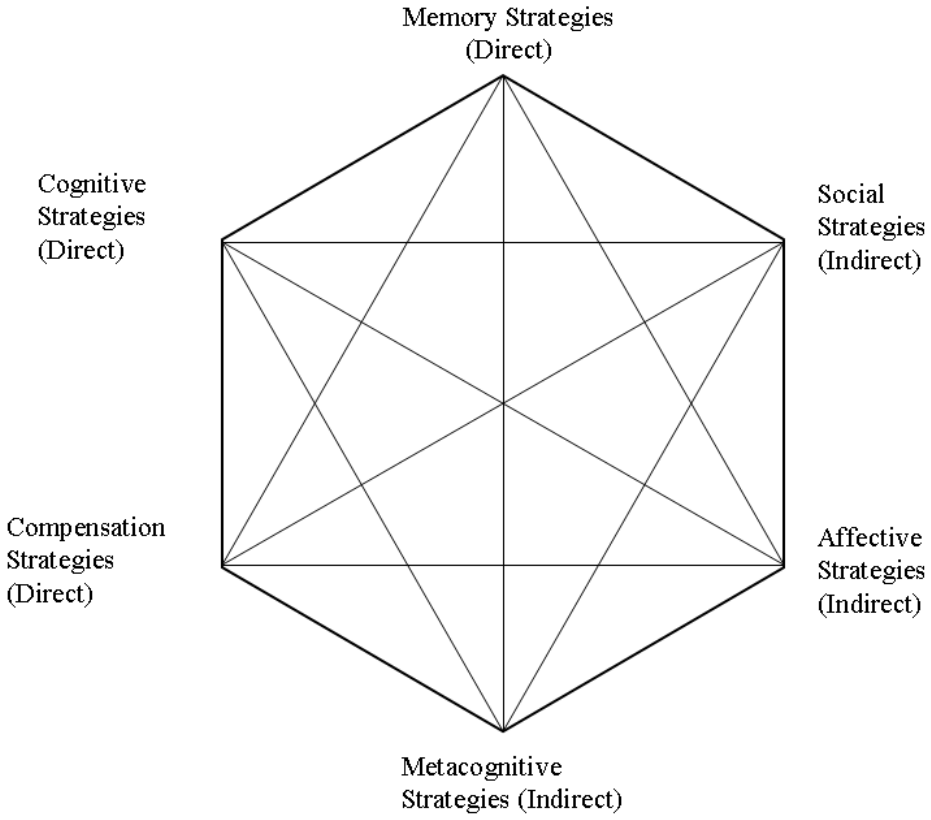
transferable to new situations" (Oxford, 1990, p. 8). The transferability of strategies beyond the language course will not only provide success to the student in the current course but increase their independence in other courses.

Direct or Indirect Strategies

As Oxford developed the idea of language strategies, she published her book in 1990 entitled, Language Learning Strategies: What every Teacher Should Know. This book provides the background insight into the use of language strategies and expands this concept by creating a VLS taxonomy. She goes on to provide different examples of different strategies that are used or can be used in the classroom. One of the best visual representations of her taxonomy was the image of a star with the student in the middle and all of the different points being a different type of strategy.

Figure 1

Diagram of VLS Taxonomy



(Oxford, 1990, p. 15)

According to Oxford (1990), all VLS can be divided into direct and indirect strategies. Direct strategies as implied by the name are directly used by the student to learn a target language. This area is divided into memory, cognitive and compensation strategies. Memory strategies are: creating mental images and linking them to prior knowledge and sounds, actively reviewing materials and employing actions to learn the new vocabulary. Cognitive strategies are: practicing, receiving, processing and responding to analyzing vocabulary. Finally, compensation strategies are, using educated guesses, overcoming writing and speaking in the new language by

relying on a strategy. All of these strategies are viewed by Oxford, (1990) as directly being used by the student to acquire lexical knowledge.

In contrast indirect strategies are those strategies which assist in the maintenance and transferability of VLS. Indirect strategies are also divided into three sub categories. First, metacognitive strategies are: when a student focuses on their learning, this can be achieved by arranging and planning for learning and evaluating learning. Next, affective strategies are: when the student is able to lower their anxiety by encouraging themselves and identifying frustration before it becomes anger. Finally, social strategies are: the ability to ask questions, cooperate with others in and out of class and empathizing with other students to strengthen the learning community.

Research on Vocabulary Learning Strategies

Research into VLS has explored a variety of aspects such as types of strategies, unstructured vs. structured approaches, effects of explicit instruction and if direct or indirect VLS increases on ESL adult academic success.

In order to identify the different types of strategies that student use. Sanaoui (1995) conducted an exploratory study of 50 ESL students taking a 6-week vocabulary course at a University in Canada. Over the study period, participants were asked to monitor and record daily use of vocabulary strategies and report their findings with other participants in the course. The sharing sessions were 60 minutes once a week for the duration of the study. "By the end of this 6-week inquiry the researcher observed that learners seemingly fell into two groups: those who organized the task of vocabulary learning and those who did not appear to approach vocabulary in any obviously organized way" (Sanaoui, 1995, p. 17). The data collected from the participants showed a division in student participation. One group identified the use of strategies

in note taking, creating a personal dictionary and making personal wordlists to learn new vocabulary. On the other hand, data indicated that the other group would show up to class ready to learn the new material without any plan or prioritization of learning activities.

Structured and unstructured VLS were a focus for Sanaoui. Sanaoui (1995) noted that this exploratory study suggests that more research in this area is necessary and extended this first study by conducting a case study of four ESL learners' approaches to vocabulary learning. Two of the participants were from a beginner language proficiency class and the other two were from an advanced proficiency class. Participants were asked to identify and record the use of vocabulary strategies, and these daily notes were collected from each individual at the end of the week. The research used this data to start the weekly interview discussion and asked participants to share their strategies with the researcher. "These 3 participants devoted time to independent study and reported engaging in self-independent study and reported engaging in self-initiated learning tasks, such as writing a letter in English to a friend while making efforts to use several new words in the dictionary that has been encouraged during the day, and underlining new words and finding out their meaning form a dictionary while reading a short story or novel," (Sanaoui, 1995, p. 18). These three participants also kept lists of special lexical items in personal dictionaries to assist in their language acquisition. The final participant did not have as clear language goals as the other three participants therefore notes that she did not spend as much time actively working on developing her lexical knowledge (Sanaoui, 1995). Though all participants noted that they used various mnemonic devices such as, "repetition, imagery, association of word to be learned with another word in the first or second language, using the new word in a sentence, drawing, talking about the word with someone, and acting out the word," (Sanaoui, 1995, p. 19). Overall based on these studies, Sanaoui (1995) states that there are two extreme

approaches in understanding vocabulary learning which are structured or unstructured. Sanaoui's conclusions can be compared to Oxford's VLS taxonomy by identifying that structured approaches are similar to Oxford's direct VLS and unstructured approaches are similar to direct or indirect VLS.

Structured and unstructured approaches to VLS as proposed by Sanaoui (1995) were explored further by Lessard-Clouston (1994). As an instructor of a TOEFL preparation class, Lessard-Clouston in Toronto and applied VLS for students' throughout his course. At the start of this course, students were asked to fill in a questionnaire about how much time they spend on self-initiated learning. The following week students were asked to fill in a vocabulary knowledge questionnaire (VKQ) adapted from Sanaoui (1992) followed by the time spent questionnaire (Lessard-Clouston, 1994). After the researcher examined the data, participants were engaged in a discussion about the results. "On the VKQ, the average score for the class was 63.7%, indicating that many students had learned many of the words they said they had. Overall, the class median score was 70%, suggesting general success among students in their self-stated vocabulary learning," (Lessard- Clouston, 1994, p. 73). It has been noted by the researcher that instructors need to model both teaching VLS and course content but the focus needs to be on the latter.

Even with research reporting that instructional focus needs to be on content, Mizumoto and Takeuchi (2009) studied the effectiveness on explicit VLS instruction. Their study consisted of 146 female English first language (EFL) participants from two Japanese universities. Over a 10-week duration the two groups were divided based on vocabulary test results into an experimental group and a control group. Mizumoto and Takeuchi provided explicit instruction on VLS for the experimental group only through regular language lessons. At the end of their study the

vocabulary test was re-administered to both groups. Qualitative analyses also included through open ended question to explore the findings. They reported that:

> 1) Explicit teaching of VLSs results in improved vocabulary test scores.
> 2) Explicit teaching of VLSs results in increases of strategy use among learners with lower and moderate levels of such use.
> 3) Explicit teaching of VLSs may result in little change among learners with high levels of use; however, their teaching can confirm already held beliefs about their effectiveness.
> 4) Some VLSs are quickly rejected due to their time-consuming nature or being perceived as inefficient in other ways.
> 5) Explicit teaching of VLSs may result in more intrinsically motivated learners. (Mizumoto & Takeuchi, 2009, p. 443).

Overall, it has been noted that strategy instruction is more beneficial for struggling students therefore providing these strategies to all students may be beneficial.

Lessard-Clouston reproduced and extended research into VLS in the 2008 study, conducted a study at a large Christian Graduate School of Theology (GST) in Canada. All of the participants in this study were taking the Introduction to Theology I which is a requirement. "As about 40% of the students at the GST are ESL learners, the participants in this study were five NNES and six NES students in the course who volunteered to participate," (Lessard-Clouston, 2008, p. 37). The researcher met individually with each participant and asked them to complete a Test of Theological Language (TTL) and extended the data collection into individual interviews with open-ended questions. At the end of the term, participants were re-interviewed to gather data about the different participant's general vocabulary. During the last two weeks of the course, each participant was asked to complete an Approach to Vocabulary Learning Questionnaire (AVQ) adapted from Sanaoui (1995) and Lessard-Clouston (1996). The AVQ provided insight into the participants' use of VLS. "It is concluded that while more and less successful participants are represented across language backgrounds and approaches to technical vocabulary acquisition, NNES students in academic contexts may nonetheless want to

incorporate some structure into their approaches to technical vocabulary learning in order to gain greater depth knowledge of the specialized vocabulary in their field," (Lessard-Clouston, 2008, p 52). Overall, the research noted that the results were mixed about structured versus unstructured participants' course success.

It has been noted in this research that VLS does play a positive role in the lexical development of ESL adult learners. More research needs to examine the impact of direct or indirect VLS has on specific content language acquisition. Oxford and subsequent researchers in VLS did not investigate the number of VLS being use, the choices of VLS or how VLS changes over time.

The Overlapping Waves Theory

The Overlapping Waves Theory is Siegler's (2004) attempt to describe strategic variability and how and why students select specific strategies from a variety of strategies. "The theory is based on the assumption that the evolution of children's strategies, like the evolution of species, is based on the processes of variability, choice and change," (Siegler, 2004, p. 356). The Overlapping Wave Theory suggests that a human moves between roughly four different strategies. "A new strategy can be either superior or inferior to existing ones, depending on when it is used; subtracting by counting up rather than counting down is one such case. Thus, learning frequency reflects acquisition of new strategies," (Siegler, 2004, p. 360). Consequently, strategies may become specialized to specific problems or become less generalized if used in one context.

According to Siegler (1996), the cognitive variability identified by his Overlapping Waves Theory is evident at all levels of analysis. There are five dimensions identified in the Overlapping Waves Theory: "acquiring appealing strategies, mapping strategies onto new

problems, strengthening strategies for consistent usage within given problem sets where they have begun to be applied, refining choices among optional strategies or alternative forms of a single strategy, and executing appealing strategies increasingly efficiently (Chen & Siegler, 2000)," (Galis 2008, p. 4). The microgenetics model was the foundation in identifying strategy use for learning and the Overlapping Waves Theory explains an individual's use of different strategies at one time.

Research on the Overlapping Waves Theory

Research using microgenetic design has explored the use of strategies and strategic choice. This has shaped research into the Overlapping Waves Theory by exploring the use of sophisticated strategies vs. simple ones.

Understanding strategy use is a challenging endeavor due to the complexity of the individual participants as well as the task. Dowker, Flood, Griffiths, Harriss and Hook (1996) examined estimation strategies to solve multi-digit multiplication and division problems with four different groups of adults: mathematicians, accountants, psychology students and English students. All of their questions were considered basic math, therefore, all of the different groups would have been taught the concepts at a younger age. The main objective of their research was to identify if prior knowledge made it easier for an individual to correctly estimate the answer to a set of mathematical questions. They reported that regardless of the individuals' current transition phase, once they reach a high level of cognition, strategic variability enables them to respond effectively (Dowker et al., 1996). Unlike children, when adults are asked basic questions, they are able to achieve success due to their prior knowledge. "Most participants in theses studies, regardless of age, used at least three strategies," (Siegler, 2004, p. 358). In this

adult study conducted by, Dowker, Flood, Griffiths, Harriss and Hook (1996), their results confirmed Siegler's Overlapping Waves Theory by using the microgenetic method.

In order to understand the number of strategies that students' at-risk use to read, Tunteler and Resing (2010) researched verbal reasoning skills and memory of fifty-four, second grade students in the Netherlands. Students chosen for this study were at risk of becoming struggling readers. The researchers applied the microgenetic method through a repeated-measure test requesting students to identify the number of strategies that they were taught and were tested over a period of time. They reported that children who have a wide variety of strategies to choose from and who use this variety of strategies are more effective learners (Tunteler & Resing, 2010). In this study, the researchers provided scaffolding, consisting of learning, practicing and reproducing a strategy, which gave students a solid understanding of a strategy so the students could apply it as needed. Students who used only one strategy did not associate other strategies prior to the scaffolding sessions and subsequently struggled with the transferability of the strategies taught (Tunteler & Resing, 2010). This research indicates that prior knowledge and cognitive development play a key role in a student being able to choose and apply a specific strategy.

To understand choice of strategies, Siegler's Overlapping Waves Theory has been used in to understand the use of sophisticated strategies vs. simple strategic choice. Sharp, Sinatra, and Reynolds (2008), used the overlapping-wave model to classify pre-identified spelling strategies in their research in order to understand how this prior knowledge affects reading. From three different schools in southwestern United States, they identified 31 first-grade students who were at risk of becoming struggling readers. Students were randomly selected and placed into two separate groups. The purpose of this study was to demonstrate the: "(1) variability of strategies,

(2) adaptive choice and (3) gradual rate of growth in spelling" (Sharp et al., 2008, p. 222). Weekly spelling tests were administered to all students, but the participants in the study had weekly group strategy sessions to learn word structures. "In other words, we found that children adaptively used greater numbers of strategies as their orthographic knowledge increased," (Sharp et al., 2008, p. 223). This adaptive and responsive choice focuses on accomplishing a particular task. When the task becomes more difficult, the strategies an individual uses to accomplish the task become more sophisticated. But rather than moving directly from a less to more sophisticated strategy, individuals tend to hold on to what they know before advancing their thinking (Sharp, Sinatra, & Reynolds, 2008).

Summary

To understand VLS, Oxford (1990) provides the research and insight into the application and strategic use for ESL students to increase lexical knowledge. VLS can be subdivided into direct and indirect strategies that support language acquisition. Sanaoui (1992, 1995) took Oxford's taxonomy and through research identified a continuum of VLS from structured to unstructured. The Overlapping Wave Theory proposed by Siegler (1981, 1996, 2004) provides insight into the cognitive changes that happen during the process of learning. Students move between the different types of strategies based on their goals, motivation and learning preferences.

Assistive Technologies and Reading Supports

The notion that technology can be used to enhance performance challenges traditional views held by those who claim that performance of tasks without the use of technology is superior to performance which incorporates technology (Edyburn, 2007). However, as classrooms become more diverse and educators are encouraged to teach in different modes, it is

important to be aware of individual student needs and what technologies may be accessible to support their individual development. This becomes more critical in post-secondary programs where adult students enter the formal educational environment with limited prior education and, sometimes, poor English language skills. It is imperative for institutions to understand the impact of student diversity that requires a higher level of support that is difficult for teachers to provide in a large classroom. For students who struggle to master literacy skills Edyburn states, "We seek to capture the potential of technology for supporting the performance of struggling readers, such bias must be overcome in the quest to provide struggling students with appropriate tools to enhance their performance, learning, and achievement," (2007, p. 151).

Technology is a way to even the playing field for all students to have access to supportive learning. Specifically, students working towards English language acquisition or mastery in a content area, technologies could support struggling readers in a positive way.

Research on Assistive Technologies: R&WG

Special educators have been identifying assistive technologies to support the individualistic needs of their students though the use of the SETT framework (Zabala, 1995) or Ed Tech Points (Bowser & Reed, 1995). Research in this field has identified the benefits of technology support, to even the playing field for student achievement. The purpose of using an assistive technology is to provide individualized support when the student requires it by expanding their personal strategic toolbox for learning. It has been noted in educational research that one of the key challenges pertaining to educational technologies is the changing and improving software which require extra costs, training and maintenance (Edyburn, 2007). This has not prevented the field of special education from finding technological solutions to assist their students learning (Edyburn, 2007). AT devices can be categorized into three distinct functions they are; input,

output and a noninvasive scaffold to support students with special need (Dell et al., 2008; Johnston et al., 2007; Martinez- Marrero & Estrada-Hernandez, 2008). Input devices, allow the student to enter and manage a computer device, alternately output devices provide visual representation, audio or printed enhancements (Dell et al., 2008; Martinez- Marrero & Estrada-Hernandez, 2008). Low technology examples of AT are eye glasses, soft grips on pens or using voice commands on a cell phone; whereas high technology examples may include specially developed assistive software for the blind or keyboard and voice output devices for persons with physical limitations. AT exists within the education environment to maximize participation in class for students, thereby increasing their learning potential.

Assistive technologies in school are slowly changing the educational environment and, subsequently, are slowly changing teaching methods and learner outcomes (Dell et al., 2008). "By designing instruction that considers the use of AT as an instructional tool for postsecondary students with written language disabilities, one can foster more mainstream educational opportunities for these students and enhance their probabilities of achieving positive post secondary education" (Martinez- Marrero & Estrada-Hernandez, 2008, p. 60).

To ensure positive post secondary experiences for students with disabilities, special educators have used frameworks to pair the best technology with the student needs. These frameworks guide and organize the process to identify an appropriate device to meet the student's specific needs (Johnston et al., 2007). It is imperative to utilize a framework, such as SETT or Educational Tech Points to guide and gather information about the student in an organized manner for constructive collaboration (Martinez-Marrero & Estrada-Hernandez, 2008). The SETT framework developed by Zabala (1995) stands for student, environment, task and tool. Discussion can assist in ensuring the technology provided will meet the identified need

of the student to gain independence. Educational Tech Points (1995) is specific to post secondary institutions by identifying the roles and responsibilities of different staff including instructors to ensure technology success. Both of these frameworks work through this hierarchical application identifying no-tech solutions, then low-tech solutions followed by medium-tech solutions and finally high-tech solutions (Dell et al., 2008; Johnston et al., 2008; Martinez- Marrero & Estrada-Hernandez, 2008). AT services can be identified by two different approaches; first, they can be used as a compensatory adaption to solve a problem, and second, it can be a remedial adaption that attempts to correct a problem (Martinez- Marrero & Estrada-Hernandez, 2008). A framework for identifying appropriate AT adopted by the special education department can prevent students from feeling overwhelmed and abandoning technology.

Research on Reading Support

AT is used to facilitate effective functioning in a wide variety of educational environments and contexts. It is used across age, ability and grade levels. This study and literature review focuses on the use of AT to facilitate reading comprehension. This area has been researched at many different grade levels of education with an increase in post secondary institutions; therefore this literature review provides research that examines student's language development in different educational environments.

Sorrell, Bell and McCallum (2007) conducted a quantitative comparison of reading rate and comprehension between traditional teaching supports and the use of assistive technologies. Their results showed that for strong readers, assistive technologies reduced their reading and comprehension rates, while the use of technology increased both comprehension and reading rate for weaker readers (Sorrell et al., 2007). Assistive technologies provide a link for struggling students by minimizing frustrations and providing constant feedback, thus increasing success

(Sorrell et al., 2007). This observation held true for a similar study conducted on struggling readers at the secondary school level in Ireland (Lange, McPhillips, Mulhern & Whylie, 2006). Students were placed in one of three groups; control computer users, Microsoft accessibility users and the assistive technology users who were all taught the same, instructor-led literacy program (Lange et al., 2006). Similar to the previous research, assistive technologies, in particular text-to-speech and homophonic spelling tools improved test results for struggling readers compared to the Microsoft group and control group (Lange et al., 2006). All of these tools provide several advantages to students with reading difficulties such as; direct support, success and increased motivation (Lange et al., 2006). In turn this supports independence by providing individualized engaged learning opportunities for students.

Even though students are receiving assistive technologies, special educational support teachers still need to focus on the skills that are required to learn how to read or write before the device can be beneficial to the student (Durando, 2008). It has been noted not just in special education but also in reading and language programs the importance of students being taught basic language skills (Durando, 2008). When students become adults and are still struggling with reading, it clearly shows that they have not received the individualized support to scaffold their learning (Durando, 2008). Assistive technologies have been incorporated into college curriculum to address reading weaknesses that developed earlier on in a student's educational experience (Engstrom, 2005). For example, Engstrom (2005) conducted two case studies that examined the benefits of AT that American students have identified when registered in a reading and writing development class. The purpose of using AT in this study was to provide students quick access to required tools for learning as a strategic support (Engstrom, 2005). The most prevalent concern noted in this study was the amount of time that is required to learn the device on top of

regular class assignments (Engstrom, 2005). It is imperative when supporting language development for adults with special needs for the AT to be matched with the strategic support a student needs. Students with learning disabilities have often struggled throughout their educational careers; therefore, when students have an opportunity to learn new strategies, individualized support that facilitates intrinsic motivation is necessary to support their literacy development (Silver-Pacuilla, 2006). As these students are introduced to assistive technologies by implementing them into their study habits, the individualization possible with AT will support meaningful learning (Silver-Pacuilla, 2006).

Elkind and Elkind (2007) have identified text-to-speech software (TTS) to provide reading assistance for poor readers. In their research, poor readers are defined as students that may have a learning disability or attention disorder. Often these students have similar struggles because they have problems with: "reading slowly, rereading passages, struggle to decode unfamiliar words, and interrupt their reading frequently to recover from fatigue and stress. Reading takes them much more time than it does their peers," (Elkind & Elkind, 2007, p. 11). This means that students reading below their grade level are unable to understand important concepts, and do not acquire the necessary knowledge from the text (Roberts, Torgesen, Boardman, & Scammacca, 2008). As students move into the next grade level, more complex text necessitates the conscious application of strategies; therefore, students who are not engaged miss opportunities to become proficient in comprehending complex text because they are not motivated to read (Roberts et al, 2008).

Phayer (2010) researched the benefits of TTS assistive technology for college students with Dyslexia. A case study of 22 self identified dyslexic students reported that motivation was a key struggle that they faced within the College setting. They were provided 4-6 weeks of

training on the Read Write and Gold (R&WG) program (Phayer, 2010). Over the training sessions students were taught and supported in using the different functions available on the R&WG program (Phayer, 2010). The results indicated that the R&WG program was reported as useful to support the individual needs of the students involved in the study. Specifically, they reported that the 'play/pause/forward/rewind/stop buttons' were extremely useful for 15% of students and 54% of students found the 'text reader facility' very useful (Phayer, 2010). "Synthesized speech reading of text by the computer allows users to access information aurally as well as, or instead of, reading it on the screen or in a paper version," (Disseldorp & Chambers, 2002, p. 1-2). Due to the similarities with ESL and struggling readers, educational technologies such as TTS may create the authentic, supportive activity that teachers strive to provide.

There has been limited research in the area of using assistive technologies to support the language acquisition of ESL and LL adult learners. One important support that has been researched in the special education field is the use of text-to-speech. Kilickaya (2006) identified the importance of TTS software for individuals who are blind since it enables them to read from the computer screens. Students with a learning disability or dyslexia also benefit from screen readers (Fasting & Halaas Lyster, 2005). Screen readers enable a student to click on an area of digital text and the information is read out loud using speech synthesis (Kilickaya, 2006). Most programs that have TTS function can read text in word documents, html files, PDF files and other web pages (Kilickaya, 2006). One of the limitations with TTS software is the synthesized voice is difficult for students to understand (Kilickaya, 2006). This could pose a problem for ESL or LL learners since pronunciation is a key skill necessary when learning new vocabulary. Tsai & Jenks (2009) identified that a good background in listening, such as practice, experience, instruction, will increase success with vocabulary development in class and online for ESL

students. This research also identified the need to provide repetition to hear the new language. TTS software can provide individual control over repetition of words, phrases and passages. This not only provides constant feedback but it also encourages students to be more active learners.

Summary

A literature review of the use of AT for reading support indicates that AT is effective in supporting the reading rate and comprehension of students with disabilities as well as struggling students. Specifically, the TTS features provide students control in hearing literature that they are reading, which enables them to better understand the information. Besides reading rate and comprehension issues, research suggests one of the key struggles in literacy development for some students are phonological decoding deficits that may result in word identification challenges and vocabulary development (Swanson, 1999). This is magnified for students who are learning a second language because they are trying to understand individual words at the same time as they are trying to understand the words in the context of a sentence. Studies have shown that students with weak comprehension have deficits in receptive vocabulary, semantic processing, grammatical understanding and spoken discourse (Catts, Adolf, & Weismer, 2006). Research has provided insight on how to support struggling students to increase their success and desire to continue schooling.

Post-Secondary Environment

Post Secondary institutions have a challenging task of providing supports for all students to achieve success. These students are required by entrance criteria to meet basic English language proficiencies prior to admission into programs but research indicates that some students may not have been taught sufficient basic skills necessary for fluent reading and deep processing

(Roberts et al., 2008). The Canadian Language Benchmark is a standardized test that has eight levels that assess language acquisition in the areas of reading, reading comprehension, writing, and speaking (CLB, 2009). Many college level programs require a specific level for a student to achieve prior to entering the program and when exiting the program. Many ESL students demonstrate the literacy and conversational fluency necessary for admission to post-secondary academic programs but this group struggles with reading comprehension when faced with academic and technical text requirements (Roberts, et al., 2008). As a result, ESL students are readily identified as a group that is academically at risk. Academic fluency is difficult to achieve and takes time with supports for a student to be able to transfer their knowledge (Carey & Crittenden, 2000). Educational technologies have been used in the college setting to train students on devices that they will be expected to use once they have completed the program. Due to students' limited technological awareness, many programs are now providing computer writing or computer learning programs (NorQuest, 2010).

Research on Technology and Post Secondary Education

A comprehensive review of American literacy courses identified effective practices in basic skills/development in college programs. Boroch, Fillpot, Hope, and Johnstone (2007), first defined basic skills as, "the foundational skills in reading, writing, mathematics, learning skills, study skills, and English as a Second Language which are necessary for students to succeed in college-level work," (p. 82). When applying the idea of supporting and scaffolding basic skill development at the college level different categories emerge. First, organizational and administrative practices dictate through policies which skills are most important and what achievement level the students must obtain. The programming of the college specifically identifies the number of specialized services to which students have access. Next, staff

development is mandated through the college, thus, all possible opportunities for professional growth needs to follow a theme. Finally, instructional practices explore effective andragogy techniques and technologies to support the development of basic skills in the classroom (Boroch et al., 2007). All of these categories are being addressed at many colleges but research has indicated that current practices are not reflecting current diverse students' needs.

Wald, Draffan and Seale (2009) have discovered that university students may claim to be highly knowledgeable about technologies and be flexible in their intended use but this only applies to the programs that they use daily. They are uncomfortable with learning different programs or software due to lack of prior transferable knowledge. If post-secondary institutions wish to increase their course material delivery online, web designers need to create accessible web pages for assistive technologies (Krach, 2007). One of the key issues mentioned in this study by the participants was the amount of time it took to learn new computer programs utilized by the university (Wald et al., 2009). Therefore, this extra expectation increases student frustration as they are trying to learn new programs in order to access on-line courses. Students with disabilities face more struggles in accessing course materials while trying to apply accessibility adoptions (Wald et al., 2009). Part of this problem can be attributed to the assumption that students in post secondary have gained the necessary academic independence to transfer skills to different environments (Wald et al., 2009).

Lacina (2004) conducted a literature review that distinguished different software that promotes language acquisition. The main purpose of the articles included in the review was to provide possible technologies that can meet students' diverse needs and enhance learning. The key for Lanina (2004) was the attitudinal beliefs that need to be addressed that reflect the fear teachers have about using technologies in the classroom. This stems from personal inexperience

and lack of training with software that has an impact on ESL student language acquisition. Lanina (2004) interviewed two ESL language teachers about their beliefs and ideas surrounding the impact of technologies on their classroom. Two emerging themes were identified; first, how can technologies compensate for differences in the background of students while sustaining an engaged learning environment, and second, how can technologies provide students with the ability to control their own level of learning by providing choice and extra noninvasive support during class time.

Research on ESL and Technology

Beginning in the 1960's and 1970's, computer assisted instruction in language instruction consisted of drills and practice activities (Lancia, 2004). Often the programs that are used to assist in the acquisition of new language development are the Computer-Assisted Language Learning (CALL). This computer program has often been used to provide extra practice for ESL learners to master a new language. Since that time, research indicates that isolated drills are not effective for retaining and transitioning information into dialogue (Lancia, 2004). Technology is an interface that can provide constant feedback with the benefit of creating a communicative dialogue that reinforces language development. The use of internet chat sessions, discussion boards and web quests can all serve the purpose of providing students different technological modes in communication and language development.

Gallardo del Puerto and Gamboa (2009) conducted an international qualitative study to understand the role of Information and Communication Technologies (ICTs) applied to Language Learning (LL) in online delivery. They administered an online questionnaire to obtain information about the use and need of ICTs related to LL. Due to the international nature of this research; teachers were given the option of filling out the questionnaire in any of the official

languages of the project (Basque, English, German, Icelandic, Italian and Spanish). A total of 166 international language teachers teaching a variety of academic levels completed this online survey. The first component of the survey was to establish the prevalence of computer use in daily classroom activities, as well as personal use identifying comfort among the teachers. Less than a third of teachers reported the personal use of computers on a daily basis and even less for classroom activities (Gallardo del Puerto & Gamboa, 2009). Next, the teachers identified different learning approaches they believed were most effective for language development. A majority of teachers responded that collaborative activities increased and retained language acquisition (Gallardo del Puerto & Gamboa, 2009). Ironically, though these programs were identified as most important, the results showed that teachers struggled to transfer collaborative activities into the online environment. For this reason, the researchers found that individual activities such as grammar exercises, individual work, and writing composition were consistently used. Finally, many of the teachers insisted that the lack of equipment and current software impeded the online delivery methods. The teachers also acknowledged that their own insufficient knowledge, lack of time and suitable teaching materials were contributing factors and further felt more support was needed to learn this application. All of their qualitative results lead Gallardo del Puerto and Gamboa (2009), to suggest that earlier training and stronger support from institutions could develop a collaborative online LL program.

A digital divide has been created between classrooms and schools that have access to classroom technology compared to those that do not. The difference in access can be attributed to limited numbers of computers or problems in booking computer labs in designated time frames. Egbert and Yang (2004) suggest that this divide has a negative impact on strategies that could increase cognitive development for language learners. Today, such programs are often

considered outdated and useless, but many language educators are still left to use this older software. Many schools have mandated software, which limits the teacher creativity and control of immersion of interactive experiences for their students. Egbert and Yang suggest that instructors create opportunities for interactive and meaningful social online interactions (2004). They add that students need to interact in the target language with an authentic audience that exposes and encourages the production of the new language.

Summary

Post secondary insititutions have used educational technologies to support ESL language aqusition through programs like CALL. The limitations of this program is that it does not permit student language transition or academic fluency. Overall, this review acknowledges the potential of educational technologies in the LL classroom but state that for most teachers' technology is lagging current students' needs. A recurring pattern in the attitudes and beliefs of teachers using technologies is that the notion and functions that technologies provide are promising, especially to language development but the direct link is still not supported by their institutions.

Conclusion of Literature Review

This literature review examined the areas of VLS, the Overlapping Waves Theory, and AT aids for ESL students in language development in a post secondary setting. In order to understand the information processing model, Oxford (1990) applied the concepts of direct and indirect strategy use for ESL students to gain lexical knowledge. ESL adult learners are highly motivated with a specific purpose to acquire the desired language knowledge needed to have success in a specific area. "Learning strategies are steps taken by students to enhance their own learning. Strategies are especially important for language learning because they are tools for active, self-directed involvement, which is essential for developing communicative competence. Appropriate language learning strategies result in improved proficiency and greater self-

confidence," (Oxford, 1990, p. 1). It is important for faculty and instructors to have the support of institutions to develop their own knowledge in the area of VLS, thus being able to model the strategies for their students. Oxford and Scarcella (1994) added that, "students are usually expected to learn vocabulary on their own without much guidance" (p. 69-70). As this literature review has explored the benefits and limitations of VLS on student language development, the area of strategic choice provides more insight into the cognitive processing of students.

Cognitive decisions made by students in regards to strategy use have been explored first through the microgenetics method and has developed into the Overlapping Waves Theory. The Overlapping Waves Theory was developed by Siegler to explain how and why individuals use a mixture of strategy use in order to learn. "The theory is based on the assumption that the evolution of children's strategies, like the evolution of species, is based on processes of variability, choice and change," (Siegler, 2004, p. 356). Even though this method was originally used to understand children's cognitive development, it has been applied to understand to the choices adult learners make when faced with an academic problem (Lemaire & Siegler, 1995; Siegler, 2004). Computers can assist learning by providing sophisticated strategies specific to a task which can test the Overlapping Waves Theory.

Assistive technologies have been researched in the area of special education to assist struggling students as well as students with special needs. "We seek to capture the potential of technology for supporting the performance of struggling readers, such bias must be overcome in the quest to provide struggling students with appropriate tools to enhance their performance, learning, and achievement," (Edyburn, 2007, p. 151). AT can assist student development by matching tools with the student's needs. TTS has been identified as a supportive tool for ESL and struggling readers. Educational technologies such as TTS may create the authentic, supportive activity that teachers strive to provide (Phayer, 2010). Research has identified the

benefits to language acquisition by providing student repetition in hearing the new language to support learning. TTS software can provide individual control over repetition of words, phrases and passages (Kilickaya, 2006). Assistive technologies can embody the principle of UD in supporting all students in the general classroom environment while scaffolding their individual needs. According to Levine et al. (2000), future investigation is necessary to understand the impact of constant feedback on critical reading.

Summary

Learning is an ongoing process that needs to be supported through the environment and by the instructor. Trying to learn a new language may be very challenging and frustrating, consequently the more strategies students can learn the more choices they will have to ensure their success. Post-secondary institutions expect students to have a level of academic autonomy in order to process and learn new content. Many students are entering this environment from different backgrounds and levels of education, creating a diverse classroom. Administrators need to ensure that students are supported through the ongoing training offered to faculty. To ease the struggles that faculty have expressed, technologies are slowly being explored as a solution to provide more independent learning for all students. It is imperative for education to continually research the impacts of technologies on the changing classroom environment to meet the needs of their changing student.

CHAPTER THREE

Methodology

This chapter describes the methodology used for this study. As stated in Chapter One the methodology will: a) test strategy support through the use of an assistive technology that allows students access to the features of Read &Write Gold (R&WG) at a College in Western Canada, and b) identify relationships between student strategy choices (AT features, prior academic strategies) and intervention effectiveness. The chapter is organized into seven sections: (a) research design, (b) setting, (c) participants, (d) materials, (e) intervention, (f) procedures and (g) ethical considerations.

Research Design

A quasi-experiment one group pretest-posttest design was used to structure this research study. Questionnaires prior to the commencement of the study as well as at the end of the study will provide pre and post data. During the study the researcher will ask the participants self identify strategy use to collect interval data. Participants were asked to participate in six strategy sessions to learn how to use an AT as a strategic tool for their independent vocabulary acquisition. Questionnaires with closed and open questions provided the researcher with information about the strategic choices that participants made over the duration of this study.

First, due to the small sample size, descriptive statistics are used to provide insight into the participants' prior computer experiences. This will identify how much, if any, educational computer experience participants have had and their familiarity with educational programs. By asking participants for this information, the researcher can identify how technology affected the participants and their technology learning curve.

Second, participants need to self-identify through a questionnaire prior vocabulary strategies used to learn English. This provided the necessary background information to identify participants' prior background strategy to build their literacy skills.

Third, a comparison using the Pre-Vocabulary Questionnaire and Post-Vocabulary Questionnaire will provide differences or similarities in self-identified strategy use over the research period. As well by comparing the similar questionnaire students will identify if they used the TTS feature to assist in language acquisition.

Finally, a study session evaluation will provide open-ended questions for participants to express their experience using an AT software and if the session assisted in their individual language acquisition. All of this data is voluntarily provided by the participants in this study and has been collected from individuals attending the strategy sessions.

Setting

This study took place at a community College in Western Canada. The college serves over 10,000 students at different campuses, regional sites, and distance learning courses. The college offers a choice of over 50 different programs which include: academic upgrading, employment preparation, English as a Second Language (ESL), and career programs.

One of the health care career programs is a Practical Nurse International Program (PNIP). This program is designed to support internationally educated nurses to achieve academic knowledge to pass the LPN national exam in Canada. Language training instructors are partnered with practical nurse instructors who teach students nursing concepts, clinical judgment, and communication skills. All students admitted into this program have educational proof of prior training in their respective countries and have completed level 6 on the Canadian Language Benchmark (CLB) language assessment test. The CLB is a standardized test that has

eight levels that assesses language acquisition in the areas of listening, speaking, reading, and writing (CLB, 2009). This ensures that there is a specific level of English communication prior to students starting this program.

Participants

Data was collected from four self-identified ESL adults registered in the English course at the Western Canadian College. Originally there were seven participants who volunteered for this study, due to individual reasons two withdrew from the program and one dropped out of the study. Out of the seven original participants, four (2 male and 2 female) participated and completed this study. All of the participants have moved to Canada from their respective Countries within the last five years. The purpose of this study was to identify if participants using a TTS feature of the R&WG program will increase their vocabulary development as they read medical research articles included in the course materials.

Participants for this study were in their first semester of talking the PNIP program. One of the first classes that they were required to take is an English class focusing on composition. The objectives of this course are for students to be able to analyze a health related topic and compose an essay. The critical and analytical reading, thinking, and writing skills taught in this course will assist in the completion of other courses which follow. Often students in this program do not have prior experience in analytical reading, thinking and writing in English. They also have not had the opportunity to read and analyze Canadian medical research documents. These skills have been identified by the researcher as learning obstacles which can lead to a variety of frustrations. All participants in this course are adults and have prior knowledge in the area of nursing. Furthermore, all of the students are in a full time program taking three other classes at the same time.

Materials

The different questionnaires that were used in this study were; a computer experience questionnaire, pre-vocabulary questionnaire, post-vocabulary questionnaire, study session evaluation form and blackboard supports and activities.

Computer Experience Questionnaire (CEQ). The CEQ was researcher generated and is comprised of three different sections (see Appendix C). The first section had eight questions that asked participants about the amount of time they spent gaming or on social networks on a weekly basis. Research has identified that individuals who play with different modes of technology over time will experience less frustration with newly introduced technology (Gee, 2003). Playing games and social networking creates a technology schema that learners can build on as they encounter new technology. The next section asked participants to identify from a list of twenty possible current software titles which ones they recognize. This established a baseline of technology knowledge through software identification. The last section asked participants to identify from a list of thirteen education activities which activities they have prior experience engaging in. These activities incorporate technology skills and educational software often used at the post-secondary level.

Vocabulary Questionnaire. The Pre-VQ is modeled after the Approach to Vocabulary Learning Questionnaire (AVQ) used in Lessard-Clouston's (1996, 2008) research, Sanaoui (1995) and Oxford (1996) (see Appendix D). The Pre-VQ's question sequence and question focuses are the same as listed in the AVQ with the only changes being specific course identifiers and the last section. The VQ was adapted from the AVQ by identifying the specific course which this study was researching, as well as identifying the focus of developing Health Care Vocabulary. Originally, there are five sections to Sanaoui (1995) adaption of Oxford's research,

the sections are; time spent studying, types and range of self-initiative, how participants keep records, how they study from their records and finally how they practice using technical lexical terms.

The Post-VQ included the same five sections as the Pre-VQ, plus an additional section where participants were asked to create a list of ten specialized words plus one additional section (see Appendix F). This final extra section asked students specifically about their individual use of the R&WG program as well as their individual use of the TTS function. Participants were first asked to identify which R&WG feature they used from a list of seven as well as if they found the R&WG program useful. This provided data specifically about the AT taught to support the lexical development of the participants.

Study Session Evaluation (SSE). The SSE, administered at the end of the study sessions, was comprised of open ended questions for participants to provide feedback about the different strategy sessions that they attend over the semester (see Appendix G). There were four different sections to this questionnaire. The first section asked participants to identify their attendance to the strategy sessions as well if they felt that the objectives of the strategy sessions were achieved. This was followed by two questions asking participants about the use of strategies and if they felt that the strategies taught assisted them in their courses. Next there were two questions asking participants to express their rating of the presenter and the overall sessions. Finally the last open ended questions had participants provide feedback on the value of the session, what they liked most and least about the sessions and finally any changes that they would recommend for future sessions.

Qualitative Data on the use of Blackboard Supports and Activities. To gain more data for the one group pretest-posttest design, blackboard activities were constructed to provide

students with as many practice opportunities to supports strategic success (see Appendix E). The information located on a secured site will provide information about the English class, strategy information and APA information. The second component of the site will provide six different articles, identified from their specific course material. The six randomly selected articles will have an electronic copy uploaded into the blackboard site for the use of the R&WG program. With each articles five multiple choice questions with a following strategy question were researcher generation.

Intervention

In order to gain participants for this study, the researcher was granted permission by the program coordinator as well as the instructor to have ten minutes at the end of a scheduled English class during the third week of classes. At this time, the researcher presented the study and read aloud the Letter of Information (see Appendix A) as well as the Letter of Consent (see Appendix B). Participants were asked to commit to six, one hour long face to face AT computer sessions in a computer lab on campus after their scheduled English class. Based on volunteers from the class, participants were informed that these sessions were above and beyond their regular scheduled classes, and would not influence their instructors' assessment or their relationship with the college.

Procedures

This quasi-experiment one group pretest-posttest design was used in this study. The CEQ provide computer experience prior to treatment. The Pre-VQ and Post-VQ had participants' self-identify strategy use prior and after treatment. During the duration of the study the participants were asked to use the R&WG program to read and answer question on six different articles. This data will provide more information about the one group and individual participant strategy use.

At the commencement of the first session students were asked to complete a CEQ and the Pre-VQ. To support computer program learning and avoid technology abandonment, this first session included instruction on how to navigate the program and troubleshoot the current college computer system. As time permitted, each participant received a few minutes of individualized assistance to personalize the feature bar. The purpose of individualizing the feature bar was for students to become more familiar with the functions of the R&WG program. This was to support the choice students had in choosing a voice and manipulating the speed and pitch of the voice to increase understanding. Once a synthesized voice was established, students could use the text to speech (TTS) function, pronouncer feature or the dictionary with TTS and hear the same voice. Students were permitted time to explore the R&WG program after a ten minute presentation on the program. Following the principal of Universal Design all information and extra supports were available to all participants via Blackboard.

During the second session, participants were taught how to access information on the online Blackboard program used at the college. This software program provides course activities, assessments and communication avenues for the participants to have access to at any time. As well, access to the researcher beyond strategy session permitted students to ask question and the researcher could troubleshoot technical difficulties. This established a link for the students to the researcher. In the Blackboard program the students had access to the following information: the English learning guide, APA formatting examples and documents and R&WG trouble shooting Q&A. The researcher found and posted electronic versions of selected reading passages from the course materials with the addition of five researcher-generated multiple choice questions each. These questions have been created by the researcher to provide practice for vocabulary understanding.

The third session taught participants more in-depth lessons on how to use the R&WG programs' TTS function in different programs. By reviewing with participants how to log onto the Blackboard site, navigating to find a practice article, using the R&WG software to read aloud the article and then locate the multiple choice questions, students were practicing strategic choices. During the duration of the session participants were provided time to attempt different activities to navigate the different functions and ask questions about the technology. Then participants were notified of other articles that had been located and uploaded electronically for them to listen too. Past this session, students engaged in reading the articles and responding to the multiple choice questions. Every two weeks, the students read an article and answered five multiple choice questions based on that article. When students answered a multiple choice question, a drop down menu appeared with a list of the seven different R&WG strategies: a) text –to-speech, b) pronunciation, c) dictionary, d) dictionary with speech, d) online dictionary, e) homophones and f) Other (Please list). Participants were asked to rank order the strategies they used to answer the question. For example, "type 1 by the first feature you used, type 2 by the second feature you used." Based on the premise of the Overlapping Waves Theory, this procedure was designed to elicit multiple reports of strategy use beginning in the fourth week until the end of the fifteen week term. Hence, strategy use was repeatedly measured across twelve weeks.

In the fourth and fifth sessions, participants were provided technical support in navigating the Blackboard website as well as the R&WG program. At this point of the research, participants were not taught any new features of the programs but were provided the opportunity to complete different tasks and class work pertaining to their English course.

Finally in the sixth session students were asked to complete a Post-VQ as well as a SSE. This was the last time that the researcher worked and supported the participants; therefore time was allotted for questions and answers to support their individual technology use.

Specifically, the Post-VQ asks the same questions about the participants' language learning as the Pre-VQ does with the addition of three extra questions. These questions ask about the R&WG program as well as asking the participants to list words that they have learned during the term. The SSE is an open-ended survey of participants' experiences in the study sessions. Participants indicated if using a variety of strategic approaches to answer complex questions was achieved after the five instructional sessions. They were also asked how future sessions could be improved for other participants. This provided the necessary data to compare any self-identified changes in vocabulary strategy use. As well as, providing the opportunity for participants to express their experiences during the sessions and any changes that they felt were necessary for future participants.

Ethical Considerations

Before recruiting participants, the researcher submitted a Human Ethics Research Online (HERO) application to the Education, Extension, Augustana, and Campus Saint-Jean (EEASJ) Research Education Board REB at the University of Alberta. This proposal outlined the different ethical considerations that need to be addressed to ensure participants safety and wellbeing. EEASJ REB at the University of Alberta granted permission for one year as of August 26, 2010 (see Appendix H).

A secondary proposal based on the same research was submitted to the Colleges Ethical Board for permission. This Board monitors all internal and external applied research being

conducted at the college with students or staff. The College Applied Research Advisory Committee Research Ethics Board granted permission September 21, 2010 (see Appendix I). All participants reviewed the Letter of Information and Consent Form and (see Appendices A and B). All participants were given the opportunity to withdraw in writing from the study until the last day of data collection on December 17, 2010. Free and informed consent was obtained throughout the research process. At the beginning of the study, the researcher presented the right of participants to not participate or to withdraw their participation at any point until the time of completion of data collection. In addition to establishing informed consent at the beginning of the study, the researcher revisited, explained, and obtained informed consent before commencing each study session.

Given that the population was ESL students and all documents were provided in English, and the Letter of Information as well as the Consent Form was read aloud to all potential participants. This was to prevent any confusion or misunderstanding due to the vocabulary used in the documents. As well, potential participants were provided an opportunity to ask questions in class with their peers or privately at another time.

All documents and data were kept in a locked and secure location. All electronic files were password protected. Information linking research participants' identity on hard copy documents that were collected will be deleted and shredded at the end of this project. Data will not be stored electronically past the end of the project.

CHAPTER FOUR

Results

This chapter presents the data findings of this study. The data analytic plan for this study is broken down into four sections which each correspond to a questionnaire administered. The participants' background computer experience is reported first, and then the data is presented from the Pre-Vocabulary Questionnaire, which will identify the individual strategies participants used to acquire vocabulary. This is followed by the data collected from the Post-Vocabulary Questionnaire that was used to identify similarities and differences in individual student responses. Finally, the participants' use of blackboard is reported. The second component of this analysis will be to identify participants' individual results on each questionnaire.

Descriptive Statistics

Computer Experience Questionnaire (CEQ).

The Computer Experience Questionnaire has participants provide information in three areas about their individual computer background. First, participants were asked to identify how often they have used video gaming or social networking programs. Next, participants identified on a list of twenty current software titles which ones they recognize. The twenty titles used in this section of the Questionnaire were based on a current inventory of software accessible to the general public as well as at the college. Finally, the last section has a list of thirteen different educational activities that often are required of students in a post-secondary environment. Participants were asked to identify which activities they have engaged in at the start of this research study.

Table 1.1

An Overview of Data Collected from the Computer Experience Questionnaire Reported by Each Individual Participant

Participants	**Computer Experience Questionnaire (CEQ)**			
	Average amount of hours Participants reported using Video Games and Social Online Programs	List of Software Titles Participants were able to Identify out of Thirteen	Prior Educational Activities Participants Engaged Out of Thirteen Possibilities	Identified Educational Activity Programs
Female 1	Not at all	Microsoft Word, Excel, Adobe Acrobat	23%	Library Data Base, Online Journals, Digital books.
Female 2	Not at all	Microsoft Word	30%	Library Data Base, Online Journals, HTML,WebCT.
Male 1	1-3 hours	Microsoft Word, Power Point, Skype	30%	Slide Presentation, Library Data Base, Online Journals, WebCT.
Male 2	Not at all	Microsoft Word and Power Point	23%	Slide Presentation, Library Data Base, Online Journals.

Overall, based on the participants' indicated time spent using social networks or video gaming, it can be concluded that ESL adult students do not engage in theses activates often. The participants in this study were generally not able to identify different software, which supports the first observations that ESL adult students do not engage in activities using technology. This can be due to many different variables of time, access, training or interest on behalf of the participant. Participants in this study identified a mean of 26.5% out of the possible thirteen possible different educational activities. The only activities that all of the participants have engaged in prior to this study were using a library data base and locating online journals. All of

the other activities may have not been taught to the participants or are new to the participants based on their prior educational experience.

Specifically, participant female one identified on the CEQ that she has not engaged in video gaming or social networking. This indicates that she does not use the computer in those recreational ways. Next, she was able to identify four different software titles from a list of thirteen which indicates that she is aware of a few different programs. Finally, she has used some computer programs for educational activities. Over the duration of the study this participant had difficulties logging onto the system and navigating different programs.

Participant female two identified on the CEQ that she has not engaged in video gaming or social networking. This indicates that she does not use the computer in those recreational ways. Next, she was able to identify one different software titles from a list of thirteen which indicates that she is not aware of different computer programs. Finally, she has used some computer programs for educational activities. Over the duration of the study this participant had some difficulties logging onto the system but was very determined to learn the different programs.

Participant, male one identified on the CEQ that he does engaged in video gaming or social networking. This indicates that he does use a computer in those recreational ways. Next, he was able to identify three different software titles from a list of thirteen which indicates that he is aware of a few different programs. Finally, he has used some computer programs for educational activities. Over the duration of the study this participant had no difficulties logging onto the system and navigating different programs. He supported other participants and was eager to learn new programs.

Participant, male two identified on the CEQ that he has not engaged in video gaming or social networking. This indicates that he does not use the computer in those recreational ways.

Next, he was able to identify two different software titles from a list of thirteen which indicates that he is aware of a few different programs. Finally, he has used some computer programs for educational activities. Over the duration of the study this participant had no difficulties logging onto the system but did become frustrated navigating different programs.

This CEQ provided a glimpse into the computer experiences that participates were bringing to this research study and to their program. It is imperative to identify the limited use, time, knowledge and educational activities that participants have been exposed to prior to taking this course. The researcher needed to collect this information to establish a starting point for the introduction of technology. Understanding a student's prior computer experience will also prevent participants from becoming overwhelmed and abandoning the new technology.

Pre-Vocabulary Questionnaire (Pre-VQ). Prior to the intervention, participants described the average amount of time spent studying new vocabulary. Vocabulary prior to this research constituted any English vocabulary words that they were trying to learn to assist with conversational English. This could include the studying participants did before taking the CLB exam to gain entrance into the program.

Second, it is important to know what type of language participants are using in their studies. The student descriptors indicated if participants use general academic vocabulary language to learn or if they are using health care specific vocabulary language to study.

Next, participants identified in which setting they acquire new health care language vocabulary. The setting in which students learn new vocabulary will increase or decrease transferability of knowledge to new and different environments.

Participants were now asked to identify what strategies they have used from a list prior to this study. The list had seven different types of strategies ranging from using a dictionary, asking an English native speaker to having participants entering their own strategy.

Finally, the last section of the Pre-VQ asks participants to identify if they use any special vocabulary strategy to specifically learn new words. As well asking participants to identifying if the strategy being used is for class activities or self-directed activities that the participant has decided would assist in their lexical development.

Table 2.1

An Overview of Data Collected from the Pre-Vocabulary Questionnaire as Reported by Each Individual Participant

Participants	**Pre- Vocabulary Questionnaire (Pre-VQ)**					
	Student Descriptors: Participants Self-Reported Average Time Spent Studying per Week	Student Descriptors: Participant Identification of Language Type for Learning	Student Descriptors: Participants Identified in which Setting they Acquire Health Care Language	Strategies Previously Used by the Participants for English Vocabulary Acquisition	Participants Identification of Note Taking Strategies for Studying Purposes	Participants Identification of Strategy use for Health Care Vocabulary and if for Class Work or Self Directed Activities
Female 1	2-3 Hours	General Academic	Reading and Class	28%	Yes, occasional notes on reading and class lecture.	Yes, Class Activities
Female 2	4-5 Hours	General Academic	Reading and Class	71%	Yes, occasional notes on reading and class lecture.	Yes, Class Activities
Male 1	4-5 Hours	Health Care Specific	Reading and Class	42%	Yes, occasional notes on reading and class lecture.	Yes, Class Activities
Male 2	2-3 Hours	General Academic	Reading and Class	14%	Yes, Mental Notes	Yes, Class Activities
Mean				38.75%		

Overall, participants studied vocabulary between two/five hours per week at the start of this research study and English course. Three fourths of the participants identified that they study using general academic vocabulary language; therefore, it can be inferred that most of the participants have not acquired a working level of lexical health care knowledge. All of the participants identified that they are only learning new Health Care vocabulary in class or by reading course materials. This will limit the transferability of vocabulary by limiting the participants' interaction with the new vocabulary to the classroom setting. From a list of seven different strategies which were; making mental notes, asking an English native speaker, using a paper dictionary, using an individual notebook, applying to writing assignments, using a computer to assist in finding new meanings, and applying to conversations. Participants were able to identify the use of 38.75% of the strategies listed (see Appendix D). This data provided the researcher an understanding of the strategies that participants have used prior to the study. Finally, all of the participants identified that they take notes during class time.

The specific different strategies used by the participants for vocabulary development prior to the intervention are located in the following table.

Table 2.2

Strategies Used by the Participants for English Vocabulary Acquisition

Participant	Making Mental Notes	Asking an English Native Speaker	Using a Paper Dictionary	Using an Individual Notebook	Applying to Writing Assignments	Using a Computer to Assist in Finding New Meaning	Applying to Conver-sations
Female 1			X			X	
Female 1	X	X		X		X	X
Male 1	X					X	X
Male 2						X	
Frequency	2	1	1	1	0	4	2

Specifically, participant female one identified on the Pre-VQ that she used two strategies, using a dictionary and using a computer. It is also interesting to note that this participant identified studying two/three hours per week and focusing on general academic vocabulary. She identified that she has only been learning Health Care Vocabulary through class activities and readings. She occasionally takes notes and reported that she uses strategies to complete class work.

Participant female two identified on the Pre-VQ that she used five different strategies which were, making mental notes, asking a native English speaker, using an individual notebook, using a computer and using new words in conversations. It is also interesting to note that this participant identified studying four/five hours per week and focusing on general academic vocabulary. She identified that she has only been learning Health Care Vocabulary through class activities and readings. She occasionally takes notes and reported that she uses strategies to complete class work.

Participant, male one identified on the Pre-VQ that he used three different strategies which were, making mental notes, using a computer and using new words in conversations. It is also interesting to note that this participant identified studying four/five hours per week and focusing on health care specific vocabulary. He identified that he has only been learning Health Care Vocabulary through class activities and readings. He occasionally takes notes and reported that he uses strategies to complete class work.

Participant, male two identified on the Pre-VQ that he used one strategy which was using a computer. It is also interesting to note that this participant identified studying two/three hours per week and focusing on general vocabulary. He identified that he has only been learning Health Care Vocabulary through class activities and readings. He makes mental notes and reported that he uses strategies to complete class work.

Finally, participants were asked about their individual note taking and reasons for taking notes in class. In many courses students' actively participate in learning by keeping notes. This does not mean that students use their notes as a strategy for learning. The following table will provide participants' responses about taking notes and what they use them for.

Table 2.3

Participants Identification and Reasoning for Written Records and Location for Studying Purposes

Participant	Memorization	Reviewing Later	Do you Review	Location	How?
Female 1		X	No	Notebook	Reading
Female 2		X	Yes	Notebook	Reading
Male 1	X		Yes	Notebook	Reading
Male 2	X		Yes	Book	Review
Percentage	50%	50%			

Half of the participants identified that they use their notes to memorize new vocabulary words while the other half of the students review them later. Most of the participants keep a notebook or book with all the notes pertaining to the course in one area and will read and review their records.

Overall, all of the participants identified that they use strategies to assist them in acquiring lexical knowledge and use class activities. It can be concluded then that participants have not been taught how to transfer their VLS to other areas of their learning and due to amount of new vocabulary they are trying to learn limits their application of new words to different settings.

Overall the Pre-VQ has provided the researcher the background educational experiences that students have had pertaining to VLS and studying a new language. This questionnaire was modified with two additions and resubmitted to the participants at the end of the research study.

Post-Vocabulary Questionnaire (Post-VQ). The Post-VQ is composed of the same sections as the Pre-VQ with the addition of two extra sections. First, an overview table will be reported to show the individual results as displayed in the Pre-VQ. The next section provides

data about the strategies used by the participants followed by self-reported note taking and studying habits.

The strategies identified by using the R&WG program have been divided into two separate tables. The first table will report the use of the program and the following table will identify the specific features that the participants self-reported. The final section asked participants to make a list of ten new vocabulary words that they have learned over the study as well as how they learned the word.

Table 3.1

An Overview of Data Collected from the Post-Vocabulary Questionnaire as Reported by Each Individual Participant

Participants	**Post- Vocabulary Questionnaire (Post-VQ)**					
	Student Descriptors: Participants Self-Reported Average Time Spent Studying per Week	Student Descriptors: Participant Identification of Language Type for Learning	Student Descriptors: Participants Identified in which Setting they Acquire Health Care Language	Strategies Previously Used by the Participants for English Vocabulary Acquisition	Participants Identification of Note Taking Strategies for Studying Purposes	Participants Identification of Strategy use for Health Care Vocabulary and if for Class Work or Self Directed Activities
Female 1	1 Hour	Health Care Specific	Outside Involvement	57%	Yes, occasional notes on reading and class lecture.	No, Class Activities
Female 2	4-5 Hours	General Academic	Reading and Class	57%	Yes, I keep detailed written notes..	Yes, Class Activities
Male 1	1Hour	General Academic	Reading and Class	57%	Yes, occasional notes on reading and class lecture.	Yes, Class Activities
Male 2	2-3 Hours	Health Care Specific	Reading and Class	43%	Yes, Mental Notes	No, Class Activities
Mean				53.5%		

The results were very interesting because two participants identified that they spent less than an hour each week studying new words. One participant studies about two-three hours per week and the final participant studied four-five hours per week new vocabulary words. Comparing these results to table 2.1a from the Pre-VQ, two of the participants decreased the time they spent each week studying new vocabulary words. Half of the participants identified that they use general vocabulary to learn new concepts and the other half reported use specific health care language. This is an increase of one participant moving from using general vocabulary to health care specific vocabulary for learning. One participant identified that they have started to learn more health care specific vocabulary outside of the classroom and readings. This is a change from table 2.1 where all of the participants identified that they were using learning new vocabulary in class and through class readings. Overall, the participants are using 53.3% of all the possible strategies out of seven possible choices. This is an increase of 17.75% from the Pre-VQ, although a dependent T-test (Wilcoxin) indicated this was not a significant difference, $t(4) = 0.141$, $p < .001$.

Specifically, as reported in the Pre-VQ the following table reports the individual strategy use as reported by each participant.

Table 3.2

Strategies Used by the Participants for English Vocabulary Acquisition

Participant	Making Mental Notes	Asking an English Native Speaker	Using a Paper Dictionary	Using an Individual Notebook	Applying to Writing Assignments	Using a Computer to Assist in Finding New Meaning	Applying to Conver-sations
Female 1	X	X				X	X
Female 1	X	X				X	X
Male 1	X	X				X	X
Male 2	X				X	X	
Frequency	4	3	0	0	1	4	3

Figure 2 is a visual representation of the pre and post strategy use identified in the group. The strategies that students choose from: making mental notes of words, asking a native English speaker, consulting a medical dictionary, keeping a notebook for new words, using new words in writing, using a computer, and practicing new words in conversations.

Figure 2

Number of Participants using Each Strategy Pre-VQ and Post-VQ Sessions

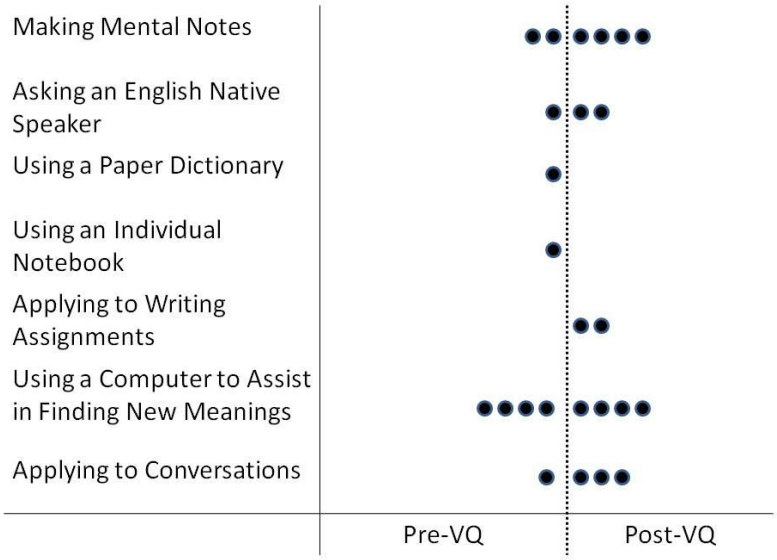
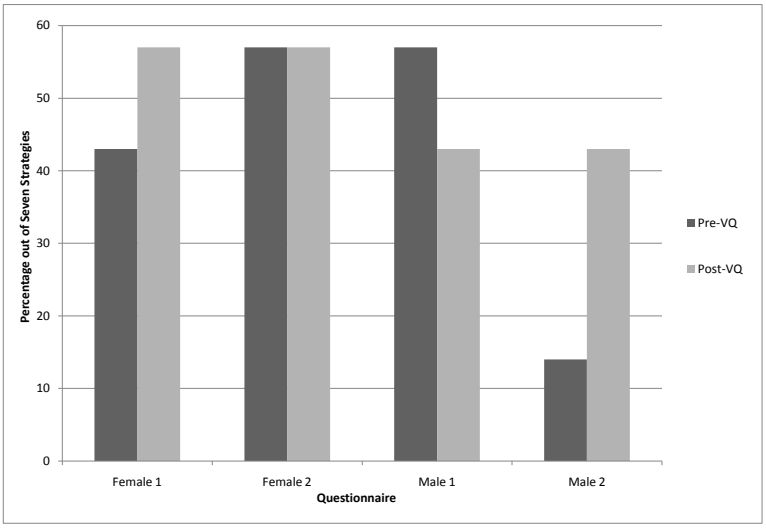


Figure 3 is a visual representation that demonstrates each participant's use of strategies from the same list of seven possible strategies on the Pre-VQ and Post-VQ.

Figure 3

Bar Graph Representation of Pre-VQ to Post-VQ Strategies Used by the Participants for English Vocabulary Acquisition



As demonstrated in the bar graph above, two of the participants increased strategy use over the duration of the term; one maintained strategy use and one decreased strategy use. The original strategies identified on the Pre-VQ were still used and retained by participants on the Post-VQ. This demonstrates the overlapping nature of strategy use as new strategies overlapped the continued use of the original strategies.

Specifically, participant female one identified on the Pre-VQ that she used two strategies, using a dictionary and using a computer. Over the duration of the study the same participant identified on the Post-VQ using a computer, making mental notes, asking a native English speaker and using new vocabulary words in conversations. It is interesting to note that this

participant identified that she studied about two/ three hours per week on the Pre-VQ which decreased on the Post-VQ to one hour or less per week.

Participant female two identified on the Pre-VQ that she used five different strategies which were, making mental notes, asking a native English speaker, using an individual notebook, using a computer and using new words in conversations. Over the duration of the study the same participant identified on the Post-VQ, making mental notes, asking a native English speaker, using a computer and using new vocabulary words in conversations. It is interesting to note that this participant identified that she studied about four/five hours per week on the Pre-VQ which stayed the same on the Post-VQ.

Participant, male one identified on the Pre-VQ that he used three different strategies which were, making mental notes, using a computer and using new words in conversations. Over the duration of the study the same participant identified on the Post-VQ, making mental notes, applying new words to writing, using a computer and using new vocabulary words in conversations. It is interesting to note that this participant identified that he studied about four/five hours per week on the Pre-VQ which decreased on the Post-VQ to studying one or less hours per week.

Participant, male two identified on the Pre-VQ that he used one strategy which was using a computer. Over the duration of the study the same participant identified on the Post-VQ, making mental notes, applying new vocabulary to writing assignments, and using a computer. It is interesting to note that this participant identified that he studied about one hour or less per week on the Pre-VQ which increased on the Post-VQ to two/three hours per week.

Overall all of the above figures show the different strategy used by the different participants as reported on the Pre-VQ and the Post-VQ. It can be concluded that the

participants increased their strategic awareness and used new strategies to assist with lexical knowledge which coincides with the amount of time spent studying each week.

The next section asked participants to identify what they use their notes for. The strategy of reviewing and rereading provides more practice with the vocabulary words that they students have learned. Note taking as mentioned in the Pre-VQ has students actively participate with the new vocabulary assisting with moving words from their working memory into their short term memory.

Table 3.3

Participants Identification and Reasoning for Written Records and Location for Studying Purposes

Participant	Memorization	Reviewing Later	Do you Review	Location	How?
Female 1		X	Sometimes	Notebook	Reading
Female 2	X		Sometimes	Notebook	Reading
Male 1		X	Sometimes	Notebook	Reading
Male 2		X	Sometimes	Notebook	Reading
Percentage	25%	75%			

Overall, one participant uses his or her notes to memorize the new vocabulary while three of the participants use the notes to review later by reading from their notebooks. All participants identified that they sometimes review their old notes; but in the structure of the English class, most of their notes were on the writing process, essay structure and a list of vocabulary. It needs to be noted that one of the participants has identified that they are now using their notes for reviewing not memorizing as identified at in the Pre-VQ.

The additional section of the Post-VQ asked participants questions about the R&WG program and features that were taught to them during the strategy sessions. The first question asked students to identify the R&WG features that they strategically used from a list of seven and to provide a reason why.

Table 3.4a

Participant Identified R&WG Feature Use out of Seven and Reasons of Use

Participant	Percentage of Features	Yes	No	Reason
Female 1	29%		X	
Female 2	43%	X		Time Saving
Male 1	14%	X		Understand
Male 2	43%	X		Learn More
Percentage	32%	75%	25%	

Overall, the participants used 32% out of seven different R&WG features that were available to them through the AT. Three out of four of the participants identified that they used the features because it was; “time saving,” “understand,” and “learn more.” The following table has identified the individual features that the participants indicated using on the Post-VQ.

Table 3.4b

Individual Participant Identification of the Seven R&WG Features

Participant	TTS	Speaking Dictionary	Word Predication	Pronunciation Tutor	Homophone Support	Spelling Support	Fact Finder
Female 1	X	X					
Female 2	X			X		X	
Male 1	X						
Male 2	X	X	X				
Frequency	4	2	1	1	0	1	0

All, of the participants have indicated using the TTS feature and the speaking dictionary was the second most common feature reported.

Participants then were asked to list ten new vocabulary words they learned over the semester without any strategy support. They were then asked to indicate if they learned the meaning of the new word in class, by using technology or both.

Table 3.4c

Individual Participant List of Ten Possible Vocabulary Words Learned Over the Study and Location

Participant	Percentage Listed	Class	R&WG	Both
Female 1	60%	83%		17%
Female 2	70%		71%	29%
Male 1	100%		100%	
Male 2	80%		50%	50%
Mean	77.5%	20%	56%	24%

Overall, participants were able to list on average 77.5%, of the ten words which is almost eight new health care vocabulary words that they have learned over the semester. On average the participants reported that they learned 20% of the words in class, 24% of the words using both technology and class materials and finally 56% of the words listed were learned using technology.

Study Session Evaluation (SSE). The SSE was comprised of open ended questions for participants to provide feedback about the different strategy sessions that they attend over the semester. The first question asked how often the participant attended strategy sessions.

Table 4.1a

Individual Participations Reflection on Session Attendance

Participant	Never	Often	Always
Female 1			X
Female 2			X
Male 1		X	
Male 2		X	
Percentage		50%	50%

All of the participants indicated that they attended the strategy session which proves that students found the session useful by attending.

The next question asked students if the objectives were met as outlined by the researcher at the start of the session.

Table 4.1b

Individual Participants Report on Objectives Met During Sessions

Participant	Not at all	Partially	Fully	Comments
Female 1		X		
Female 2		X		
Male 1			X	I learned new things
Male 2		X		Limited time at end
Percentage		75%	25%	

Overall, most of the participants identified that they felt that the objectives of learning the technological strategies were partially met. Two participants wrote in, "I learned new things," and "limited time at the end." These comments suggest that the objectives of learning VLS using technology were met except there was not enough time to master the skills.

The next question asked participants specifically if they learned new strategies and if the new strategies assisted them in acquiring lexical knowledge.

Table 4.2

Individual Participants Identification of Strategy Use as well as Strategy Benefit

Participant	Yes	No	Yes	No	Comments
Female 1	X		X		
Female 2	X		X		
Male 1	X		X		Improvement from beginning of term
Male 2	X		X		Learned new vocabulary
Percentage	100%		100%		

All participants identified that they learned new strategies over the duration of the session. They also identified that the strategies that they have learned assisted them in acquiring lexical knowledge. Two participants wrote in that they, “improved from beginning of term,” and “learned new vocabulary.” Overall, it can be concluded that the strategies that the participants learned were beneficial and useful for their lexical acquisition.

Now, participants were asked to rate the presenter on their delivery, interaction and session atmosphere. It was important for the participants to have the opportunity to provide feedback about the presenter.

Table 4.3a

Individual Participants Rating of the Presenter Delivery, Interaction and Atmosphere

Participant	Excellent	Good	Poor	Fair
Female 1	X			
Female 2		X		
Male 1	X			
Male 2	X			
Percentage	75%	25%		

Most of the participants found the presenter excellent or good over the duration of the semester. It would seem reasonable to infer that the participants were comfortable with the presenter and were able to build a rapport to ask questions.

Participants were asked to rate their overall experience in the sessions. This would include the time, presenter, materials shared, technologies and strategies.

Table 4.3 b

Individual Participants Rating of the Overall Sessions

Participant	Excellent	Good	Poor	Fair
Female 1		X		
Female 2		X		
Male 1	X			
Male 2	X			
Percentage	50%	50%		

The participants were evenly distributed between rating the sessions as excellent and good. It can be concluded that participants did find the sessions beneficial and they enjoyed attending.

The next questions participants were asked was how valuable they found the session.

Table 4.4a

Individual Participants Identification of Sessions Value

Participant	Yes	No	Comment
Female 1	X		It helped me understand computer literature.
Female 2	X		It taught me different reading strategies
Male 1	X		Improved learning and computer skills
Male 2	X		I learned a lot from Session
Percentage	100%		

All of the participants agreed that the sessions were valuable with each participant writing in a comment. The first participant wrote, "It helped me understand computer literature." It can be concluded that this participant gained technological awareness from the sessions. The next participant noted that, "it taught me different reading strategies." This participant gained more strategies to assist in reading English and medical journals. The next participant wrote that he, "improved learning and computer skills." This participant learned different strategies that increased his learning strategies and technology strategies. Finally the last participant wrote, " I learned alot from the session." This participant did not directly identify what strategies or technologies were beneficial but it can be concluded that the participant gained strategic knowledge on how to be a good learner.

The last question asked participants to identify what was most and least beneficial about the sessions over the duration of the semester.

Table 4.4b

Individual Participants Report on Most and Least Beneficial Aspects of the Sessions

Participant	Most	Least
Female 1	Review Time	
Female 2	The Teacher	Limited Time
Male 1	Using RW&G system	
Male 2	All	

All of the participants noted beneficial aspects of the sessions as providing, "review time," "the teacher," "using R&WG," and "all." One of the participants noted the least beneficial aspect of the session was the "limited time."

Qualitative Data on the use of Blackboard Supports and Activities. Blackboard activities were constructed to provide students with many opportunities to access supports for strategic success. The information included in this class site provided students the opportunity to communicate with each other or with the researcher. All the articles were part of the English course materials and electronic versions were uploaded for access using the R&WG program. Multiple choice questions to accompany each article were also included so that students could practice strategies. This procedure was meant to provide multiple measures of strategy use over time to supplement the Pre-VQ and Post-VQ data. Unfortunately, because the program was altered to accommodate multiple selections on the drop down menu, due to technical malfunctions this data was not saved properly and was lost. The only data that was able to be recovered from the system were the overall statistics identifying the use of Blackboard by participants as a group and individually.

Table 5.1

Total Blackboard use by Participants

Statistic	Value
Total user sessions:	36
Average user session length:	00:07:03
Average user sessions per day:	2
Average user sessions per day on weekdays:	3
Average user sessions per day on weekends:	1
Most active day	October 5, 2010
Least active day:	October 4, 2010
Most active hour of the day:	1:00 PM - 2:00 PM
Least active hour of the day:	9:00 AM - 10:00 AM

Overall, participants used the blackboard program throughout the semester to support their strategic learning and choices.

The Blackboard program was able to track the number of times a participant logged on and their individual total duration of using the program. It needs to be noted that there was some time spent on the program during the six strategy sessions with the researcher but the majority of time students logged in on their own.

Table 5.2

Individual Participation Use of Blackboard and Total Time Logged over Twelve Weeks

Participant	Number of Session on Blackboard	Total Duration Logged onto Program
Female 1	4	0:27:16
Female 2	7	1:19:23
Male 1	15	2:00:28
Male 2	10	1:20:33

It can be infered that the supports and activies located on the blackboard program were beneficial for the praticipants by their number of sessions as well as the time logged on. This was the easiest form of communication between the research and the participants.

Summary

The data from this study had participants provide feedback at the beginning of the session as well as at the end. Separating the data collection provided the opportunity for the researcher to observe the changes in vocabulary strategy use over one semester. Participants identified their prior computer skills and knowledge in the CEQ. It is import to note that participants did not have extensive computer background knowledge or educational technology experience. This was supported by the results in the Pre-VQ. Participants identified and shared the strategies they have already been using to acquire English vocabulary. The VQ was re-administered at the end of the strategy session with an addition of specific technology strategy sessions. Out of the four participants, three identified that they used the R&WG program to support their lexical knowledge but all have identify trying TTS as a strategy. Finally, participants were asked to provide feedback about the overall experience they had during the session. It is encouraging to report that overall the participants enjoyed the sessions and found the technology strategies useful in learning new vocabulary.

CHAPTER FIVE

Summary, Discussion and Conclusions

The first half of this chapter includes a summary of the study, a discussion of the findings, and implications for practice, recommendations for further research, and a conclusion. The second half of this chapter is to expand upon the concepts that were studied in an effort to provide further understanding of their influences on vocabulary development for ESL adult learners.

Summary of the Study

The purpose of this study was to investigate the strategic choices for vocabulary development made by adult ESL learners in a universally designed academic program. The objectives of this research study were to:

c) Develop strategy support through the use of an AT that introduces students to key programs which will familiarize them with the features of the Read & Write Gold program at a College, and

d) To identify relationships between student strategy choices (features or prior strategies) and intervention effectiveness.

In order for the objectives to be met, the framework for this study combined the empirical research in the area of VLS, Overlapping Waves Theory, and AT use in the special educational environment. All of these areas were explored and identified in the Chapter 2 literature review, and have shaped the purpose, research questions and data analysis.

Oxford's (1990) vocabulary classification system of information processing has been the foundation for numerous research studies in the area of VLS. All of this research examined strategy use by individuals specific to developing lexical language. There was no specific

research found that applied the use of an assistive technologies' different functions as different strategies. Due to the limited research combining VLS and technology, this study applied the direct VLS identified by Oxford (1990) through the application of teaching the R&WG program. Participants were able to use the TTS function to assist in the understanding of medical journals related to their course content. The TTS function was also available through the dictionary function; thereby providing participants an instant definition. These two features provide interaction with new vocabulary that the participants are required to know for their program as well as their career.

Siegler's (1996) Overlapping Waves Theory was tested using a quasi experiment one group pretest-posttest design to identity strategy development. The Overlapping Waves Theory states that an experienced learner will attempt to learn a new concept by moving between three to four existing but different strategies (Seigler, 1996). The Overlapping Wave Theory was tested to see how many different strategies participant would identify using to develop their lexical knowledge. However due to technical difficulties in the measure of strategy use across multiple time points, participant strategy use was only identified at the beginning and the end of the research project. Frequency and transition between strategies was not collected which has reduced the link of this data to the Overlapping Waves Theory. However, the Pre-VQ and the Post-VQ did indicate some overlapping of strategy use because in some cases, students retained their original strategies and adopted new ones as well. Although, due to the loss of the multiple time point data which focused specifically on the R&WG strategies, it can't be ascertained that the program itself impacted this new strategy adoption, it is possible the use of technology in general may have contributed to some of these new strategies.

It was hypothesized that by providing extra AT strategy sessions participants would demonstrate the lexical development that they desire. Participants were requested to attend six different strategy sessions to learn the computer system, their class Blackboard site and the R&WG program. At the commencement of the first session students were asked to fill in a Computer Experience Inventory (see Appendix C) as well as a Pre-Vocabulary Questionnaire (see Appendix D). These questionnaires established a baseline for the research to continue. At the end of the session participants were asked to complete a Post-Vocabulary Questionnaire (see Appendix F) as well as a Study Session Evaluation (see Appendix G). This data provided insight into the participants' prior computer experience and strategic use compared to the final strategy use. In order to provide more insight into the participants experiences open-ended questions were used. It needs to be noted that there were technical difficulties and the activity portion on blackboard comprised of the multiple choice questions were lost which limites the frequency of strategy identification collected.

Discussion of the Findings

Previous researchers Oxford and Nyikos (1989), Oxford (1990), Oxford & Scarcella, (1994), Sanaoui (1992, 1995), Lessard- Clouston (1994, 2008), and Mizumoto and Takeuchi (2009) have extensively studied the impact of VLS on ESL adult learners. As well previous researchers such as: Siegler (1981, 1996, 2004), Dowker, Flood, Griffiths, Harriss and Hook (1996), Lavelli, Pantoja, Hsu, Messinger, and Fogel (2004), Galis (2008), Sharp, Sinatra, and Reynolds (2008), and Tunteler and Resing (2010) have researched the Overlapping Waves Theory in both children and adults learning. All of these researchers have demonstrated the importance of providing individuals with strategic choice and a variety of different strategies to use. The goal of my study was to identify factors noted by participants that strategically

supported their lexical development. This section discusses the implications of the findings for each of the three research questions.

Research Question One

What strategies are used by ESL students' to build vocabulary? To answer this question the researcher first collected data on the participants' prior use of strategies. In the Pre-VQ, participants were asked to identify strategies that they were already using to develop English vocabulary. All of the participants had identified different strategies that they used regularly to learn specialized language.

Overall, all participants in this study have identified that using a computer has assisted them in finding the meaning of words that they do not know. In order to remember and expand their schema in this area, 75% of the participants then use the words in conversations or in class to practice. Finally, half of the participants have identified that they make mental notes of phrases, thus activating working memory (Lessard-Clouston, 2008). All of the participants have identified at least one strategy that they use in order to learn new vocabulary as well some of the participants identified that they used more than one of the strategies.

An important finding of this study was the amount of time participants have identified to devoting for new vocabulary development (see table 2.1). Fifty percent of participants identified that they spent about two/three hours per week learning new vocabulary while the other fifty percent spend about four/five hours per week. Both of these groups expressed the importance of spending time studying specifically for vocabulary development. Another strategy identified in data analysis is note taking during class time. All of the participants identified that specific vocabulary is taught in class and through the course materials (see table 2.1). In Table 2.2, 100% of the participants identified that they take regular notes in class. Specifically, 25% of

participants identified making mental notes with the materials while 75% of students make occasional notes on reading and class lectures. Participants found that studying course notes and class reading materials are effective strategies in order to learn new vocabulary. Finally, 50% of the participants identified that they memorize new vocabulary while the other 50% will review the words later (see table 2.3).

From the Post-VQ, this research study indicates that the ESL adult participants used direct VLS as identified by Oxford (1990) to develop their lexical knowledge. As stated in Chapter Four, the participants noted that 50% of the time they study they used a strategy for vocabulary acquisition. One direct strategy reported by the participants was the active note taking that they all did in class and reviewing the notes by rereading them. Participants were asked if they engaged in extra vocabulary strategies through classroom-based activities or if they were self-directed. All of the participants reported that they used class strategies for class activities and none of the participants engaged in any self-directed activities to build their lexical knowledge.

Participants have identified individual strategies that they use to develop and grow specific Health Care vocabulary. This indicates that there are specific VLS that individual students use to structure their learning (Oxford, 1990 & Sanaoui, 1992). All of the strategies that were identified in the Pre-VQ (see Appendix D) are strategies that the participants had already been taught and are part of their learning schema. In addition to comparing changes in the use of strategies, it is important to identify existing strategies to determine if participants are moving between the new strategy and older ones as proposed by Siegler (1996). Identifying and applying a strategy is an educational skill in itself. Oxford and Scarcella (1994) identified the need for programs to teach ESL students how to choose strategies, apply the strategy to the

problem and review the outcome that the strategy provided. It is difficult for students who are already inundated with vocabulary overload to process any strategies that could assist in learning. “Strategies which learners use in approaching early technical vocabulary learning in their chosen disciplines may thus influence both their acquisition of it and their academic socialization” (Lessard-Clouston, 2008, p 33). Direct VLS skills, as identified in this research and other research explored earlier is often the focus in VLS research. It is more challenging to have participants identify indirect VLS unless the participants are cognizant of the strategies being used. ESL adult learners are highly motivated and goal driven, therefore when provided a strategy that could potentially save time and increase learning they will attempt it. As reported in Chapter Four, three of the participants reported in the questionnaire that they preferred the R&WG program because it saved time, increase understanding, and learning. Similar to Sanaoui’s (1995) study, students who are motivated, will structure their strategic use to maximize learning potential. On the other hand students that are not motivated or do not have concrete goals will not invest as much time or initiative to learning the new vocabulary.

Based on this research study and the empirical evidence explored and applied to this study, it can be stated that motivated ESL learners will use direct or structured strategies to increase their lexical development by using VLS.

Research Question Two

Does the use of AT increase ESL students’ vocabulary? Qualitative data was collected from the participants about their experience in the strategy sessions and if they believed that the R&WG, AT assisted them in building their vocabulary skills. Therefore, students were asked reflective open-ended questions to provide insight into their experiences during the strategy sessions and while using technology.

All participants identified that they attended the strategy sessions, 50% identified that they often attended while the other 50% attended always (see table 4.1). The participants were asked if they believed that the session meet the objectives of the sessions as expressed by the researcher at the start of the research project. Overall, 75% of the participants felt that the session partially met the objectives while 25% felt that they objectives were fully met. Two of the participants included the comments: 'I learned new things' and 'limited time at the end' (see table 4.1).

Specifically, one question on the SSE (see Appendix G) asked participants if they learned strategies and if the strategies assisted them. All students responded positively and commented: 'improvement from the beginning of term' and 'learned new vocabulary' (see table 4.2). This question was followed by another which asked, if the participants found the sessions valuable. All of the participants indicated that the sessions were valuable, with the following comments: 'It helped me understand computer literature,' 'It taught me different reading strategies,' 'Improved learning and computer skills,' and 'I learned a lot from session' (see table 4.4a). Participants also provided an overall rating of the sessions. Half of the participants indicated that the sessions were excellent while the other half indicated that the sessions were good (see table 4.3b). Finally, at the end of the Study Session Evaluation Form, participants were asked to identify what was most and least beneficial about the session. Some of the written comments were that the most beneficial were: 'review time,' 'the teacher,' 'using the R&WG system' and 'all.' These comments illustrate that each participant found a different aspect beneficial but all of the participants did learn something new. One negative response to this question which was echoed by other respondents was that the time for these strategies sessions were limited due to other obligations (see table 4.4b). As reported in chapter four, participants in this research study

stated, that they all learned new strategies and strategies assisted them in their individual vocabulary development. One of the participants has noted an improvement in him/her vocabulary from beginning of term to the end. While another participant responded that the strategies assisted him/her in learning new vocabulary. Specifically, when examining the outcome of AT use for students it needs to be noted that:

> "The AT perspective seeks solutions that take into account a student's strengths and weaknesses, which are then used to create an independent technology-enhanced plan for the student to overcome his or her limitations. The UDL perspective looks to create flexible instruction, engagement, and assessment options that reduce barriers at the outset of the learning process," (Messinger-Willman and Marino, 2010, p. 9).

Universal Design for Learning (UDL) is the application of UD to the educational environment and AT provides students access to building on their strengths to compensate for their weaknesses.

Although historically AT has only been used by students with disabilities, applying UD has expanded the use of AT to a greater variety of students. Since AT in a UD environment can support all individual students, students who are struggling, in particular ESL students have benefited from constant access to this support. The importance of basic language skills has been noted in reading and language programs (Durando, 2008). When adults students continue to struggle even in post secondary programs, it has been noted that they many have not received the individualized support necessary to master reading (Durando, 2008). Engstrom (2005) conducted two case studies that examined the benefits of AT for college students registered in a reading and writing development class. Engstrom (2005) applied the AT as a quick access strategic supportive tool for the students to increase their learning. It was suggested by Engstrom that to support language development the AT tool needs to be matched with the strategic support the student needs.

It can be concluded from this study and the review of research that AT does assist in adult ESL vocabulary development. As the participants noted in table 4.4a, "it helped me understand computer literature, it taught me different reading strategies, improved learning and computer skills, and I learned a lot from session." This statement may not speak directly to the R&WG program as increasing their vocabulary knowledge; however it can be inferred that the AT did improve their learning experience which in turn has increased their vocabulary knowledge.

Research Question Three

Does the TTS feature assist in student lexical acquisition? To answer this question a comparison of the Pre-VQ and the Post-VQ will identify initial and learned strategy use, as well as identify if the TTS feature assisted in student language acquisition.

Participants identified that the three main strategies that they have used for vocabulary development were using a computer to find word meanings, using new vocabulary in conversations or in class, and making mental notes. All of the participants had the same amount of time to learn and practice new strategies. "… cognitive development can be more accurately characterized by a pattern of overlapping waves that represent developmental trajectories of adaptive strategy use," (Sharp, Sinatra, & Reynolds, 2008, p. 206). During this study participants identified strategies they used at the beginning of the research as well as at the end. There were variations of direct strategy use and it can be concluded that through trial and error participants self-selected the most beneficial strategy for their vocabulary development (see figures 3). As shown in figure 3 individual participants changed the strategies they used but maintain at least one from the Pre-VQ to the Post-VQ. This data links participants used different strategies to the Overlapping Waves Theory because they still maintain a strategy which they

have had success with. It has been noted in research that when new more sophisticated strategies are taught a participant would move between what they know and attempting the new strategy to ensure success. Over all, three of the participants increased in their strategy use while one decreased their strategy use by one to four different strategies. The final tally for each participant was that female one used four different strategies, female two used four different strategies, male one used four different strategies and male two used three different strategies. This again reinstates the Overlapping Waves Theory when Seigler (1996) states that an experienced learner will attempt to learn a new concept by moving between three to four different strategies.

Participants were asked three additional questions in the Post-VQ (see Appendix F). All of these questions helped to identify the strategic support that the R&WG program provided through the TTS feature. Over all 50% of participants used the TTS feature. In addition, 50% of participants used the Speaking Dictionary which uses the same synthesized voice as TTS. It can be concluded then, that three out of the four participants used a strategy of a synthesized voice to increase vocabulary development. Participants did explore and use some of the other features that the RW&G program provides which resulted in a net increase in the use of technology for strategies support. Over all 50% of the participants wrote that they used other technologies and the internet, to assist in their vocabulary development.

Next, participants were asked if they found the R&WG program helpful with their English class material. In total 75% of the participants indicated ‘yes’ it was helpful for the following reasons: ‘time saving,’ ‘to understand,’ and ‘learn more’ (see table 3.4a). It can be concluded then that a TTS feature which is flexible can assist in the vocabulary development of

ESL learners. This strategy like all other strategies is individual to the students needs and must prove to be beneficial in order for it to be placed into the students' learning schema.

Participants in this research study identified the used of TTS when trying to read and understand digital literature. As reported in Chapter Four, Table 3.4b, 100% of participants used the TTS feature as well 50% of participants used the Speaking Dictionary. Both of these R&WG features use the same synthesized voice for student to hear the new vocabulary being pronounced. Although only 50% of the participants used both features, data indicates that three of four participants did use a synthesized voice output for strategic support. Participants were asked to list new vocabulary they have learned over the duration of the study and if they learned the word from using technology or from class. Overall participants were able to list 77.5% of new vocabulary without assistance and 56% of those words were learned with technology. By examining the data specifically within the context of TTS, participants were taught strategies to use their strength of listening to better understand English. Participants in this study have mastered the CLB level six for conversational English; therefore they have the contextual understanding of processing new vocabulary within a sentence structure. "One type of technology development to overcome these students reading problems are computer programs that provide synthetic speech output, synchronized with text (Kelemes, Epstein, Zuker, Grinber, & Ilovitch, 2006) such as text to speech software," (Phayer, 2010, p. 22). The strategy of listening and re-listening was studied by Tunteler & Resing (2010). Their research study examined the effect of verbal reasoning skills and memory of vocabulary on struggling readers. By providing students the entire context that the word is presented in, students were able to better understand the meaning of the unknown word.

Although TTS was included as a main strategy for participants to learn and apply to their independent vocabulary development, this was not the only strategy that students used. Oxford and Nyikos (1989) state, that good language learners use a variety of learning strategies. Oxford identified a taxonomy of direct and indirect vocabulary learning strategies. (Oxford, 1990). This framework connects to Seigler's (1996) Overlapping Waves Theory that identifies an individual's movement between three or four different strategies. "A new strategy can be either superior or inferior to existing ones, depending on when it is used; subtracting by counting up rather than counting down is one such case. Thus, learning frequency reflects acquisition of new strategies," (Siegler, 2004, p 360). It can be concluded from this study and the review of research that TTS features has the potential to assist ESL lexical development, however more research needs to identify a higher frequency use of the strategy. It can be concluded that providing strategic options may be the best way to scaffold students' lexical development and educational success.

Additional Analyses

It is important to note that most of the participants in this study had limited, if any experience using technologies. In the CEQ (see Appendix C), participants were asked to identify the amount of time and types of programs they have used prior to this research. This was important data to collect in order to identify the technology learning curve that these participants were facing.

Overall, 88% of the time participants do not use any video games or social online programs prior to this class. Playing games or using technology as a social medium may be indicators of comfort with technology and ability to navigate within a computer based environment (see table 1.1). Next participants were asked to identify current software titles that

are widely used on a variety of computer programs. In total, the combined participants were able to identify six different software from a list of twenty; therefore only identifying 30% of current software (see table 1.1). Finally, participants were asked to identify computer-based educational activities that they have engaged in. Overall, participants identified being engaged in 26.5% of the educational activities prior to this research. Some of the activities that they identified were: library data base searches, finding online journals, using digital books, slide presentation, and using WebCT (see table 1.1). This data has enabled the research to identify the participants as having limited technology experience and limited educational technology experience which needed to be addressed in strategy session.

To conclude, participants may not have had extensive computer experience but based on the other data mentioned participants were motivated to learn new technologies to assist their learning. At times the research was asked to assist with basic computer skills. Some participants forgot how to log into the computer system and authenticate, while others needed some assistance in saving, retrieving and e-mailing documents. It is believed that these skills are key for the participants to understand and use the R&WG program; therefore time was provided for individual participants support as they develop mastering technology first is essential to applying technology in a strategic manner. (This is an unanticipated but significant finding)

Summary

In summary, the four participants in the English strategy session did acquire new strategies in the area of vocabulary development. Direct VLS assisted students in achieving the desired lexical understanding to have success in the English course. Although the data did not provide any evidence of indirect VLS used by the participants it is importance of both indirect and direct strategies to supporting student transferable development (Oxford, 1990). The

specific impact of VLS, supports student's individual information processing by activating cognitive awareness of different strategy use. As stated in Siegler's Overlapping Waves Theory, students move between three to four different strategies in order to learn a new concept (Siegler, 2004). Participants in this research study were provided a variety of strategies, problems and time to apply new vocabulary strategies to different activities. Finally, all learning is a gradual process that assumes that participants change their strategic process of learning. This research has identified the strategic changes that have occurred in the literacy development of specific vocabulary knowledge for ESL adult learners. It is imperative to acknowledge that this research focused on participant self-identified strategic use to actively support individual learning processes. All participants required support to use computer technology as a tool for vocabulary expansion. This support was provided through ongoing strategy sessions which afforded participants a supportive environment where they were able to ask questions and learn how to use the technology through trial and error. This was supported by continuous strategy sessions that increased the opportunity for participants to ask questions and learn through trial by trial.

Implications for Practice

Post secondary institutions, specifically community colleges, are facing an increase in enrollment of ESL learners. As this will increase the diversity in the classroom, educational, community institutions will need to respond to the unique challenges that the new student population will produce or create. Changing student populations result in modifications to how faculty instructors are delivering their courses. As this research has identified, teaching students strategic learning skills may be a transferable and useful skill as students pursue academic autonomy. The following section will outline possible considerations that will promote strategic learning.

The first consideration needs to apply to the classroom as well as the entire post-secondary environment. UD has been identified in research as well as in this study as strategic support for all students. A principle of UD is that educators proactively shape the environment to accommodate individual differences. By designing proactively a wide variety of individual difference and preferences will be addressed and all students will have equal access. Specifically, in this study UD was only possible in the strategy session conducted by the researcher. This was extended by the current agreement for a site license for the R&WG program to be accessible on all of the computers on campus. One of the questions that the participants did ask during the study was if they could have access to the program at home. This limitation decreased the accessibility and use of the RW&G program for the participants at all times, an important principle of UD. Slowly changing the environmental structure will better meet the needs of the new diverse population. These principles support all students in the classroom regardless of their individual needs (Rose et al., 2005). Administration needs to work with faculty to provide more students, not just ESL learners, and the benefits of the UD environment.

Secondly, faculty needs the opportunity to become more involved in integration of technological strategies through professional development. Research has indicated that faculty instructors are feeling overwhelmed with technological expectations, the diverse student population and the expectation to apply best practices in the classroom (Gallardo del Puerto and Gamboa, 2009). All levels of post secondary education need to work together to provide time for collaboration and professional development. Input about best practices cannot be limited to the staff members only; therefore students are starting to play a larger role in providing necessary feedback to improve teaching. In the pursuit of the scholarship of teaching, faculty are starting

to share more ideas for incorporating technology, and best practices as strategic teaching. These changes are not drastic but do require support for faculty to learn and then apply different strategies into their daily lessons. It is imperative the positive experiences from this study can be continued by providing more choices for students to gain academic autonomy.

Finally, student support services need to be more integrated into all areas of the post secondary institution. With an increase of inclusion, student support services have the knowledge and experience to share with other faculty to support the diverse environment. This not only will provide support to students with special needs but extend supports to struggling students and staff members. In many current post secondary structures student support services are a very small department that is mandated to only support students with special needs. As the post secondary educational environment changes towards online, the identified diverse population can benefit from using AT. Student support services could provide sessions for students and faculty to attend and learn more about accessibility of AT features. By increasing dialogue on AT strategies, student support services will be able to share other strategic learning skills with the entire institution. This working relationship will work both ways because faculty will gain more support by being able to discuss concerns and issues and student support services can be proactive in response to student needs.

These implications for practice are based on this study that focused on student strategic choices. It is important that programs which are student focused ensure that their faculty is able to respond to student feedback. By creating a positive and collaborative environment everyone involved will gain new strategies to learn and work more effectively.

Recommendations for Further Research

The goal of this study was to investigate the effects of VLS choice on ESL lexical development. Data was collected to test three research questions relating to this goal. The data was studied and significant findings have been examined. The findings have some limitations. First, due to the short time frame there were only a limited number of technology strategies taught and supported for students to gain lexical development. This impacted the time students had to prioritize other commitments and schooling with availability to practice. Another limitation of this study was the small sample size. The statistical results were not significant but individual experiences suggested that AT was beneficial as a VLS.

Further research into this use of technology for strategic support is necessary. As stated earlier in the study there is no prior research in the area of using AT to support ESL lexical development. This area needs to be examined and explored on a larger scale to understand the impact of AT on lexical development.

Conclusion

The findings of this study expand the work of previous researchers in the area of VLS, Overlapping Wave Theory and AT. This investigation revealed that ESL adult students will structure their studying and apply technological strategies to acquire lexical knowledge if taught how to use the strategy and how to use the technology. A literature review indicates that when students are taught how to use strategies to support their individual learning they will apply the different techniques on their own. It does depend on individual student learning preferences and background knowledge, but the ESL participants in this study were highly motivated to reach their individual goal and were motivated to learn new strategies.

Realistically, educational technologies including AT, pose new issues for institutions to consider before teaching technological strategic choices. Post secondary institutions will have to consider how to keep up with the changing market of technologies and provide retraining on new programs. The fact still remains that faculty will need to have comprehensive, multidimensional and diverse training and support to meet their classroom needs. Technologies can make learning more interactive and enjoyable, but the basic, non-technology based strategies still need to be taught in a classroom. This then will develop programs that meet the current needs of diverse students.

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APPENDIX A

Letter of Information

An Investigation into the Use and Benefits of Assistive Technologies for English as a Second Language Users' Literacy Development

This research study is being conducted by Ewa Wasniewski, a graduate student working with Dr. Patricia Boechler in the Department of Educational Psychology at University of Alberta, Alberta, Canada.

The objectives of this research are to: a) develop strategy support through the use of an Assistive Technology that introduce students to key programs which will familiarize them with the features of the 'Read & Write Gold' program at a College, and b) to identify relationships between student strategy choices (features or prior strategies) and intervention effectiveness. Students will participate in group study sessions which will be an hour in length and run weekly for twelve weeks in the fall semester at a College. Students will then be asked to complete a 'Computer Experience Questionnaire' to provide background computer skill information and 'Pre-Vocab Questionnaire.' On the last session students will be asked to complete a 'Post- Vocab Questionnaire' and a survey to understand their session experiences. The other sessions will provide information and supports in the area of study skills, computer skills, navigation of different programs, researching skills and APA formatting.

There are no known risks associated with your participation in this study. Participation is completely voluntary and the researcher has no role or influence in assigning grades. It is anticipated that the data will be compiled by December 2010. Before this date, if you decide you would like to have your data removed from this study please inform the researcher via e-mail. As a participant in this study you are entitled too a copy of the final research report. You are not obliged to answer any questions that you find objectionable. You will not be identified in any way if the results are published and nothing will connect you to your responses. All data will be stored in a secure computer file accessible only to the researchers until published, at which point the files will be erased from the computer.

Any questions about study participation may be directed to Ewa Wasniewski at ewa.wasniewski@norquest.ca. Any ethical concerns about the study may be directed to the Chair of Faculties of Education, Extension and Augustana Research Ethics Board (EEA REB) at the University of Alberta at (780) 492-3751.

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and the University of Alberta's policies.

Thank you again for your participation,
Ewa Wasniewski - Graduate Student
Dr. Patricia Boechler - Faculty Supervisor

If you consent to participate in this study, please read and sign the Letter of Consent.

APPENDIX B

Consent Letter - Students

An Investigation into the Use and Benefits of Assistive Technologies for English as a Second Language Users' Literacy Development

Date: August 5, 2010

Researcher: Ewa Wasniewski
Department of Educational Psychology, University of Alberta

You are being asked to participate in a research study. Before you give your consent to be a volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Purpose of the Study

In this study, we hope to learn more about supporting ESL student Language Development using assistive technologies. Research findings will be used to complete a Thesis in Educational Technologies with hopes of publication and to inform our teaching practice. Students currently enrolled in the PNIP and are registered to take the English are being asked to participate in this study.

Commitment for the Participant

As a participant in this study, you will be asked to complete 12 group sessions. Each session will be approximately 60 minutes each week during the Fall semester. During these sessions you will be taught how to use an Assistive Technology to support independent learning of vocabulary through interactive activities. All of the activities and information for the session will be posted on the class secured website. You will also be asked to complete a 'prior computer skill inventory' to provide background computer skill information and a 'pre and post strategy questionnaire'.

Total time to participate is 12 hours which will be completed in 12 sessions.

The study will also include reviews of assignment marks as well as CLB results.

Potential Benefits

You may benefit personally from your participation in this study based on the strategies you may learn. As well, the information obtained from this research will potentially benefit future ESL students and students at other institutions.

Voluntary Participation

You may choose not to participate in this study without any impact on your relationship with the College. You may also withdraw from the study at any time by telling the researcher in writing. The researcher has no role or influence in assigning grades. It is anticipated that the data will be compiled by December 2010. Before this date, if you decide you would like to have your data removed from this study please inform the researcher via e-mail. As a participant in this

study you are entitled too a copy of the final research report. To obtain a copy of the final research report, contact Ewa Wasniewski at 644-6069, ewaw@ualberta.ca

Confidentiality and Anonymity

The researcher will ensure the confidentiality and anonymity of participants is protected through the following steps:

1. Information linking your name to the participant code will be kept in locked storage during the study and will only be available to the researcher. This information will be destroyed at the end of the study.
2. Your name will not appear in any report, publication or presentation resulting from this study.

The research data, with identifying information removed, will be kept for a period of 3 years and will be securely stored in a locked storage room in the Educational Psychology Department at the University of Alberta.

Questions

If you have any questions about participation in this study, please ask the researcher. If you have additional questions at a later date, please contact Ewa Wasniewski at 644-6069, ewaw@ualberta.ca or Dr. Patricia Boechler at 492-7273, patricia.boechler@ualberta.ca.

This project has been reviewed by and received ethics clearance through the Research Ethics Review Committee at the College, as well as the Faculties of Education, Extension and Augustana Research Ethics Board (EEA REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EEA REB at (780) 492-3751.

Consent Form

I have read the information presented in the letter about the study being conducted by Ewa Wasniewski, at this College. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

Surveys

- ❑ I understand that I will be asked to complete 3 surveys. I understand that all information which I provide will be held in confidence and I will not be identified in any resulting report or publication. I understand that I may withdraw this consent at any time without penalty by advising the researcher.

- ❑ I agree that excerpts from the survey may be included in the reports or publications to come from this research, with the understanding that the quotations will be anonymous.

Document Review

- I understand that my CLB results and course results will be included in the study. I understand that all information which I provide will be held in confidence and I will not be identified in any resulting report or publication. I understand that I may withdraw this consent at any time without penalty by advising the researcher.

Online Participation

- ❑ I understand that all of my activities and postings on the secured Blackboard website will be included in the study. I understand that all information which I provide will be held in confidence and I will not be identified in any resulting report or publication. I understand that I may withdraw this consent at any time without penalty by advising the researcher.

Withdrawal from Study

- ❑ I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

Publication of Results

- ❑ I am aware that excerpts from my participation in the research may be included in publications that come from this research, with the understanding that quotations will be anonymous.

With full knowledge of all of the above, I agree, of my own free will, to participate in this study.

_____ _____

Participant Name Participant Signature

_____ _____

Witness Name Witness Signature

Date: _____

APPENDIX C

Computer Experience Questionnaire

Name: _____ Date: _____

In this section, please circle the letter that most applies to you.

1. In recent weeks, on average, how often did you play video games during the course of one week?

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

2. When you were in High School, how often did you play video games during the course of one week?

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

3. When you were in Junior High School, how often did you play video games during the course of one week?

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

4. When you were in Elementary School, how often did you play video games during the course of one week?

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

5. In recent weeks, on average, how much time during the course of one week did you spend social networking (e.g., E-mail, Facebook , MSN, Twitter).

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

6. When you were in High School, how much time during the course of one week did you spend social networking (e.g., E-mail, Facebook , MSN, Twitter).

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

7. When you were in Junior High School, how much time during the course of one week did you spend social networking (e.g., E-mail, Facebook , MSN, Twitter).

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hours

8. When you were in Elementary School, how much time during the course of one week did you spend social networking (e.g., E-mail, Facebook , MSN, Twitter).

A) Not at all B) 1 – 3 hours C) 4– 6 hours D) 7 – 10 hours E) >10 hour

In this section, please check off each software title that you recognize:

__ Microsoft Word	__ Skype
__ Gears of War	__ MatLab
__ WriterMate	__ Halo
__ Towers	__ Naturally Speaking
__ CiteMagic	__ KJ Rate
__ Tetris	__ Access
__ Powerpoint	__ Adobe Acrobat
__ Infinite Legend	__ SPSS
__ EndNote	__ Final Shot
__ Forecast	__ Alpha Tank Division
__ Smash ‘ N Grab	__ WordDirect
__ Inspiration	__ Grand Theft Auto
__ NotePack	__ PowerGen
__ All Account	__ SNRP
__ Speech Complete	__ Dreamweaver
__ Excel	__ Metal Vanguard
__ Spyder Web-weave	__ The Sims
__ Cal Math	__ World of Warcraft
__ Blinkers	__ Secret Mind Garden
__ Winzip	__ Final Fantasy

In this section, please check off the computer activities you have engaged in:
__ building a website
__ creating a slide presentation
__ creating a spreadsheet
__ using formulas in a spreadsheet
__ compressing files
__ creating a PDF document
__ using library databases
__ accessing on-line journals
__ writing HTML code
__ writing other programming code
__ using statistical packages
__ accessing digital books
__ using a learning management system like WebCT or Blackboard

APPENDIX D

Pre-Approach to Vocabulary Learning Questionnaire

The purpose of this questionnaire is to provide information on your language learning in the English course. The information you provide here is confidential for the purposes of the study. Thank you for taking the time to do so.

Name: _____

1. Approximately how much time per week do you spend outside of class, on average, on previous course? (Including reading, reviewing notes, etc.)

___ No time ___ One hour or less ___ 2-3 hours___ 4-5 hours ___ 6-8 hours ___ 9 or more hours

2. Would you say that most of the language you are learning is mainly:

___ General academic English (for reading, writing, etc.),
or
___ Health Care-specific terminology (words, phrases, & expressions)

3. Does the Health Care language that you are learning come mainly:

___from the readings, class lectures, etc.
or
___ from your involvements outside of the courses (at work, in self-study, etc.)

4. In your learning of the specialized language of Health Care in English, do you regularly: (Please check all that apply)

___ make mental notes of words, phrases, expressions, etc.

___ ask native English speakers the meaning of words

___ consult a medical dictionary about specific terms if so, which dictionary:_____

___ keep a vocabulary notebook or have a system for compiling new words

___ practice new words and phrases in papers you are writing

___ use a computer to assist you to find the meaning.

___ practice new words by using them in conversation, classes, etc.

___ other (Please specify) _____

___ other (Please specify) _____

5. Do you take regular, written notes during the class lectures?

___ No ___ Yes If yes, in what language:_____

6. Which statement below best describes what you do: (Choose one)

___ I prefer to make mental notes of the specialized language I am learning.

___ I keep occasional written records, by making notes on my readings, in the text, in my class lecture notes, etc.

___ I keep detailed written records of the words, phrases, and language I am learning, i.e. in a vocabulary list, book, on cards, in a notebook, etc.

7. If you keep written records, which statement best describes you? (Choose one)

___ My main reason for writing down English words, phrases, and expressions is to help me memorize them.

___ My main reason for writing down English words, phrases, and expressions is so that I can come back and review them later.

8. If and when you write down English words you are learning in class or in your own study time, where do you write them?_____

9. Do you review the words, phrases or expressions you write down?
___ No ___ Yes

If yes, how often do you review these words, phrases or expressions:
___ rarely ___ sometimes ___ often ___ very often

10. How do you usually review the English words you write down?_____

11. Do you make a special effort to practice the special vocabulary you are learning in your writing (course papers, etc.) or speaking?

___ No ___ Yes If yes, please summarize how you practice it:

_____
_____

12. Which statement best describes what you do? Check one:

___ My opportunities for practicing the special vocabulary I am learning in Health Care come mostly from class activities, homework, readings, etc.

___ My opportunities for practicing the special vocabulary I am learning in Health Care come mostly from self-initiated activities outside the course

APPENDIX E

From Both Sides Now

By Sharon Begley, with Thomas Hayde

One story from the annals of science seems destined to become a minor classic among certain biologists, and it is no coincidence that it concerns sex. Out on the Western plains, biologists were studying herds of mustangs, in which the reigning stallion was believed to have the sole right to procreate. Then a researcher got the bright idea of running DNA tests on the horses. As paternity tests often do, these proved embarrassing: fewer than one third of the herd's foals had been sired by the resident stallions. Instead, mares had snuck over to other herds, mating with males there. Blinded by the "harem" metaphor of mustang social structure, researchers had not even looked for such female behavior.

As such examples accumulate, more and more scholars are wondering whether cultural forces such as feminism affect the direction and results of research. In her new book, "Has Feminism Changed Science?" Penn State historian Londa Schiebinger answers with a definite yes. "Science is not value-neutral," she argues. "Getting the right answers--turning the crank--may be gender-free. But it is often in setting priorities about what will and what will not be known that gender has an impact." The claim is inflaming the "science wars," with their battles over whether science is as isolated and objective as partisans claim.

That's the key: it is not that men and women do science differently, but that they choose different questions to pursue, says biologist Patricia Adair Gowaty of the University of Georgia. "The women's movement of the 1960s and 1970s had a huge effect on me," she recalls. "Ideas I was exposed to I have since erected as testable, scientific hypotheses." One hypothesis involves asking under what circumstances female bluebirds have... well, extramarital affairs. "This is how feminism has changed science," says Gowaty. "I'm not doing the science any differently, but I'm asking a question that has not been asked before." Gowaty suspects that a female bluebird risks "extra-pair copulations" if she is healthy and a good forager, which would allow her to support her offspring even if her cuckolded mate left. "By answering this question," says Gowaty, "we'll know more about female biology." And maybe not only the avian kind.

Although most scientists dismiss the idea that there is a female "way of knowing"--holistic, nondominating and cooperative--many recognize that the different experiences men and women bring to the lab lead them to scrutinize different aspects of nature. Marine biologist Mary Beth Saffo of the University of Arizona was startled when she looked around a 1989 conference on symbiosis--often beneficial relationships between living things, like the little fish that clean parasites off sharks in return for table scraps. "The majority were women," she says. Was it a coincidence? In the '50s and '60s, says Saffo, biologists tried to understand ecosystems "through a framework of antagonism and competition." "There's more interest in and recognition of mutualism now," or cooperative relationships between species. Although Saffo doesn't go so far as to attribute the shift to feminism, it did coincide with the flood of women into ecology.

Something similar happened in the study of humans' primate relatives. From the 1950s to the 1970s primatologists studied savanna baboons. This species is more aggressive, male-dominated and competitive than any other nonhuman primate. "Most of these scientists were men," says primatologist Linda Fedigan of the University of Alberta. The species they chose, she says, reinforced the notion that male dominance and aggression are the norms of primate behavior, including ours, and that it is the males who bring social cohesion to the troop. When feminism

and women entered the field, in the 1970s, they upended the stereotype of the passive, dependent female, and questioned the idea that male aggression and alliances are the most powerful shapers of primate society. Instead, it turns out that elderly female baboons determine where the troop will forage each day, and a male's reproductive success depends less on his place in the dominance hierarchy than it does on his relationships with the troop's females. And when women began studying primates other than baboons, they found that females actively pursue males and have loads of extramarital affairs--apparently to get more males to provide and care for the babies. Now females are no longer considered peripheral to primate evolution.

Feminism has also changed ideas about how humans evolved from quadrupedal apes to toolmakers, thinkers and talkers. In the 1960s the answer was unquestioned: hunting. The story was that men who learned to cooperate, communicate and make weapons in order to hunt stimulated their brains and drove evolution. Women tagged along and pushed out babies every few years. But female anthropologists now have other ideas. In "Lucy's Legacy," to be published in November, Alison Jolly of Princeton University argues that behavior where females excel (language and forming social bonds) or roles that fall to females (forging links between generations) played the key role in human evolution.

But would these insights have come even if feminism never existed? "Because the changes came so quickly after the feminist critique, they must be at least a bit in response," says Linda Fedigan. But have feminists exaggerated their effect? Schiebinger and others claim that it took feminists to overthrow the dogma about active, heroic sperm pursuing the fat, passive egg, and substituting the now standard view that the egg plays an active role in conception by sending out fingerlike microvilli to reel in a sperm. Biologist Paul Gross isn't buying it. "The argument about feminism focusing attention upon the egg is absurd and dishonest," he says, because the egg's active role was noted in textbooks even in the 1960s. "If that's all 'feminist science' can claim as an achievement, then it's a joke." But it does make other claims, in fields from mustang matings to human evolution. If it turns out that the questions science poses, and the answers it seeks, are not walled off from society, maybe that's as it should be.

Begley, S. (1999). From both sides now. In S.D.Scott, D.Perkins & E. Rothwell (Eds.), *Intersections: Readings in the sciences and humanities* (pp. 6-9). Toronto, ON: Pearson Education Canada.

Practice Questions with Read & Write Gold.

1. Based on the article “From Both Sides Now,” what is a feminist?
    a. Only women
    b. Someone that fights for equal rights
    c. Someone that wants things done their way
    d. Some one who believes in fake science

Please rank order the strategies you used to answer the question above. For example, type 1 by the first feature you used, type 2 by the second feature you used etc…..

a. text –to-speech
b. pronunciation
c. dictionary

d. dictionary with speech
e. online dictionary
f. homophones
g. Other (Please list):

2. In science the meaning of a hypothesis is?
    a. Someone's idea
    b. How researchers get paid.
    c. A proposed explanation for an observed event.
    d. A guess.

Please rank order the strategies you used to answer the question above. For example, type 1 by the first feature you used, type 2 by the second feature you used etc…..

a. text-to-speech
b. pronunciation
c. dictionary
d. dictionary with speech
e. online dictionary
f. homophones
g. Other (Please list):

3. In this article the word evolution means?
    a. Is a change that happens over generations
    b. Only happens to animals
    c. A change that makes things worse
    d. Everything around us.

Please rank order the strategies you used to answer the question above. For example, type 1 by the first feature you used, type 2 by the second feature you used etc…..

a. text –to-speech
b. pronunciation
c. dictionary
d. dictionary with speech
e. online dictionary
f. homophones
g. Other (Please list):

4. In the following sentence what does the word exaggerated mean? "But have feminists exaggerated their effect?" (Befley, 1999, p 8).
    a. Something very long
    b. That feminists have done too much
    c. That feminists have done too little

d. That there is no place for women in science.

Please rank order the strategies you used to answer the question above. For example, type 1 by the first feature you used, type 2 by the second feature you used etc…..

a. text –to-speech
b. pronunciation
c. dictionary
d. dictionary with speech
e. online dictionary
f. homophones
g. Other (Please list):

5. What is the Theme of this article?
    a. That men are better at science then women
    b. That women will never be as good as men in the field of science
    c. That women can only study behavior of animals
    d. That over the years many women have increased the knowledge of science

Please rank order the strategies you used to answer the question above. For example, type 1 by the first feature you used, type 2 by the second feature you used etc…..

a. text –to-speech
b. pronunciation
c. dictionary
d. dictionary with speech
e. online dictionary
f. homophones
g. Other (Please list):

APPENDIX F

Post-Approach to Vocabulary Learning Questionnaire

The purpose of this questionnaire is to provide information on your language learning in the English course. The information you provide here is confidential for the purposes of the study. Thank you for taking the time to do so.

Name: _____

1. Approximately how much time per week do you spend outside of class, on average, on the English course? (Including reading, reviewing notes, etc.)

___ No time ___ One hour or less ___ 2-3 hours___ 4-5 hours ___ 6-8 hours ___ 9 or more hours

2. Would you say that most of the language you are learning is mainly:

___ General academic English (for reading, writing, etc.),
or
___ Health Care-specific terminology (words, phrases, & expressions)

3. Does the Health Care language that you are learning come mainly:

___from the readings, class lectures, etc. in Introduction to English and other course work,
or
___ from your involvements outside of the courses (at work, in self-study, etc.)

4. In your learning of the specialized language of Health Care in English, do you regularly: (Please check all that apply)

___ make mental notes of words, phrases, expressions, etc.

___ ask native English speakers the meaning of words

___ consult a medical dictionary about specific terms if so, which dictionary:_____

___ keep a vocabulary notebook or have a system for compiling new words

___ practice new words and phrases in papers you are writing

___ use a computer to assist you to find the meaning.

___ practice new words by using them in conversation, classes, etc.

___ other (Please specify) _____

___ other (Please specify) _____

5. Do you take regular, written notes during the class lectures?
___ No ___ Yes If yes, in what language:_____

6. Which statement below best describes what you do: (Choose one)

___ I prefer to make mental notes of the specialized language I am learning.

___ I keep occasional written records, by making notes on my readings, in the text, in my class lecture notes, etc.

___ I keep detailed written records of the words, phrases, and language I am learning, i.e. in a vocabulary list, book, on cards, in a notebook, etc.

7. If you keep written records, which statement best describes you? (Choose one)

___ My main reason for writing down English words, phrases, and expressions is to help me memorize them.

___ My main reason for writing down English words, phrases, and expressions is so that I can come back and review them later.

8. If and when you write down English words you are learning in class or in your own study time, where do you write them?_____

9. Do you review the words, phrases or expressions you write down?
___ No ___ Yes

If yes, how often do you review these words, phrases or expressions:
___ rarely ___ sometimes ___ often ___ very often

10. How do you usually review the English words you write down?_____

11. Do you make a special effort to practice the special vocabulary you are learning in your writing (course papers, etc.) or speaking?

___ No ___ Yes If yes, please summarize how you practice it:

_____
_____

12. Which statement best describes what you do? Check one:

___ My opportunities for practicing the special vocabulary I am learning in Health Care come mostly from class activities, homework, readings, etc.

___ My opportunities for practicing the special vocabulary I am learning in Health Care come mostly from self-initiated activities outside the course.

13. Please identify any or all of the following features that have assisted you in Vocabulary development through the English class.

__ text-to-speech
__ speaking dictionary
__ word predication
__ pronunciation tutor
__ homophone support
__ spelling support
__ fact finder
__ other:_____

14. Did you find using the Read & Write Gold program helpful to your learning in the English course?

___ Yes ____ No

Reason? _____

13. Without consulting any notes or books, please list up to ten specialized words, phrases or expressions that you have learned in this course (i.e., you didn't know them before). Where did you mainly learn them? In class lectures, from using technology, or both? (please check below)

1. _____ ___ Class ___ Technology ___ Both
2. _____ ___ Class ___ Technology ___ Both
3. _____ ___ Class ___ Technology ___ Both
4. _____ ___ Class ___ Technology ___ Both
5. _____ ___ Class ___ Technology ___ Both
6. _____ ___ Class ___ Technology ___ Both
7. _____ ___ Class ___ Technology ___ Both
8. _____ ___ Class ___ Technology ___ Both
9. _____ ___ Class ___ Technology ___ Both
10. _____ ___ Class ___ Technology ___ Both

APPENDIX G

Study Session Evaluation Form
(Use reverse side to provide additional comments)
Date: _____

1. How often did you attend the sessions?

2. How well did the session meet its stated objectives (not at all, partially, fully)? Why?

3. Did you learn useful strategies for approaching complex questions in a variety of reasonable ways? If so what kind?

4. Do you feel that you have improved your ability to evaluate new information and analyze the central ideas of this subject area?

5. Please rate the presenter(s): excellent, good, fair, poor. Comments?

6. Please rate the overall session on content (excellent, good, fair, poor) and presentation (excellent, good, fair, poor).

7. Was the session valuable for you? Why?

8. What did you like most and least about the session?

9. What feedback do you have for the presenter(s) to improve in the future?

Thank you for your feedback!

APPENDIX H

Notification of Approval - Delegated Review

Study ID:	Pro00016495	
Study Title:	An Investigation into the Use and Benefits of Assistive Technologies for English as a Second Language Users' Literacy Development.	
Study Investigator:	Ewa Wasniewski	
Study Supervisor:	Patricia Boechler	
Date of Informed Consent:	Approval Date 8/25/2010 8/25/2010	Approved Document Consent Letter Letter of Information.doc

Thank you for submitting the above ethics application to the Education, Extension, Augustana and Campus Saint-Jean Research Ethics Board (EEASJ REB). Georgios Georgiou has reviewed your application and, on behalf of the EEASJ REB, approved it as of August 25, 2010. The approval will expire on August 24, 2011.

A renewal report must be submitted prior to the expiry of this approval if your study still requires ethics approval at that time. If you do not renew before the renewal expiry date, you will have to re-submit an ethics application.

Sincerely,

Dr. Stanley Varnhagen
Chair, Education, Extension, Augustana and Campus Saint-Jean Board (EEASJ REB)

Note: This correspondence includes an electronic signature (validation and approval via an online system).

APPENDIX I

Applied Research Advisory Committee
Research Ethics Board

Review Results		
Project Name	An Investigation into the Use and Benefits of Assistive Technologies for English as a Second Language Users' Literacy Development.	
Submission Author	Ewa Wasniewski	
Date Reviewed	07 Sep 2010	
Expedited Review		**Full Review** ✓
Approved as submitted		
Approved with changes	Approval with changes Granted 21 Sep 2010	
Denied		
Name:	Ann Moore	
Signature:	*Ann Moore*	

Changes

Provide consistency of information across all documents.
Remove request for birthdates from all documents.