UNIVERSITY OF CALGARY

Knowledge Retention in Computer-based Training

By

Douglas Reid

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER OF ARTS

GRADUATE DIVISION OF EDUCATIONAL RESEARCH

CALGARY, ALBERTA

APRIL, 2001

0-612-65050-2

ABSTRACT

The purpose of this study is to evaluate the effectiveness of knowledge retention review activities exercised after an instructional session using computer-based training (CBT). As part of a training session on a piece of productivity software called Microsoft Outlook 97, 42 adults were randomly placed in one of three groups, treatment with no review activities, treatment with user generated review activities, and treatment with program generated retention activities. All participants completed a content evaluation test on four different occasions spread over 60 days. The participants also completed two surveys to investigate attitudinal differences in relation to computers and technology. Each participant completed the content test and a pre-training survey then received computer-based training for one day. Immediately following the training, the content test was again completed. The content test was administered again 30 days and 60 days after the training day to determine the effectiveness of the knowledge retention activities performed by each group. The second attitudinal survey was completed 30 days after the training day.

The results showed significant differences between the groups before the training began, during the study and after the study was completed. The group of users who trained on the program which generated daily retention activities achieved significantly higher on all four content tests than the other two groups. Possible reasons for these results and implications for further study are discussed.

ACKNOWLEDGEMENTS

To Dr. Michele Jacobsen for advising me throughout my program.

To Dr. Bill Hunter for helping me and teaching me how to get things done.

To Dr. John Mueller for being on my committee.

To Gisela Engels for all her patience.

To Mark Wylie for structuring his thesis in a straightforward manner (Wylie, 1999).

To Profound Learning Systems for funding this project.

And to Dr. Larry Katz for supervising this project.

DEDICATION

To Cory and Carson,

Your examples in the face of adversity have shown me how to overcome any obstacles life may place in my path.

To Michele,

You have helped me more than you can possibly know.

To Donovan,

For introducing me to new cultures.

To Weston and T'Ne,

It's nice to feel at home.

Finally, to the Big Boss and the Handsome Man,

Long may they prosper in tales of yore.

"There are three kinds of lies: lies, damn lies, and statistics."

Disraeli

"If the hill has its own name, then it's probably a pretty tough hill."

Marty Stern

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Computers and the Internet have revolutionized the way people in developed countries socialize, communicate and work. Computers have also changed the way we educate (Ross, 2000). While educational research has produced insights into how to enhance performance, one area of investigation that has been largely neglected is the retention of knowledge by learners who use computer-based training. More research needs to be done on how learners might retain the gains they may have made from their training experience on the computer (Clariana, Ross & Morrison, 1991). Retention of knowledge is vital in an increasingly competitive business world where it is considered to be neither time nor cost-effective to train employees more than once to enhance their performance.

The concept of knowledge retention is complex. Research studies that link the concepts of knowledge retention and computer-based training are scarce. It was this scarcity in the literature that was the impetus for this study, to begin to encapsulate the concepts of computer-based training and the knowledge retention of adult learners.

This study compares the knowledge retention of adults trained on two different instructional programs. This study examines three different formats for post-instruction retention activities, which includes a control group that performed no post-instruction retention activities. This design was adopted to limit intervening variables such as content and the length of the study.

The main purpose of this study is to evaluate the effectiveness of knowledge retention activities that participants performed during and after training on Microsoft Outlook 97. The effectiveness of knowledge retention activities was based upon participant performance on a 100 question Microsoft Outlook 97 content test, given four times over 60 days and the results of two questionnaires which contain items about demographics, attitudes, semantic perceptions and opinions about computers. Based upon the performance and affective variables, this study attempts to determine which type of retention activity is most effective for adult learners in the workplace. The formats of evaluated knowledge retention activities were quite different for the 60 days following the initial training. The three groups differed as follows:

1. SWIFT (SoftWare Intelligent Freeform Training) with no review activities
2. SWIFT (SoftWare Intelligent Freeform Training) with user generated review activities
3. PLS (Profound Learning System) with program generated retention activities

The *Profound Learning System*, designed by Profound Learning Systems Inc., is an Internet-based instructional software program designed to individualize content retention activities after the instructional sessions end (Profound Learning Systems, 2000). The retention aspect of the program is run by the PLEngine, which modifies the retention questions to suit the individual learner and provides feedback to the learner about their achievement.

SWIFT (SoftWare Intelligent Freeform Training), designed by Gemini Learning Systems Inc., is a CD-ROM based instructional software program designed with an interactive Adaptive Learning Environment (ALE) (Gemini Learning Systems, 2000). During instruction, SWIFT uses an adaptive testing algorithm, which shortens testing time while determining the learners mastery or non-mastery of the course.

The null hypothesis of this study is that there will be no significant performance difference in knowledge retention after 60 days between participants using PLS with program generated retention activities, participants using SWIFT with no review activities and participants using SWIFT with user generated review activities to learn Microsoft Outlook 97.

There are other questions that were secondary to this study. They include:

1. Does learner attitude about computers have an effect upon content test performance?
2. Does learner behaviour in regards to retention activities have an effect upon test performance?
3. Does experience with computers have an effect upon test performance?
4. Does daily computer usage have an effect upon test performance?
5. How much do people remember using after computer-based training?

6. Does the study have an effect on learner attitudes regarding computers?
7. Would the individual participants perform on the post-tests in a manner similar to the rest of their group?

CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to review in-depth the literature in the fields of knowledge retention and instructional technology. First, an overview of current research findings regarding memory and recall including a review of how memory and recall issues affect learning is presented. Then the literature involving learner and instructor attitudes regarding computers, including how learner attitudes about computers affect computer-based training is reviewed. The chapter concludes with a review of the current literature involving computer-based training. This conclusion explores the definition of computer-based training (CBT) and differentiates CBT from other technology-based forms of instruction.

Memory and Recall

A great deal of the current literature on memory and recall focuses on how people process information (Burns, Curti & Lavin, 1993; Compton & Logan, 1991; Okolo & Ferretti, 1996; Smith, 1998). Cunningham and McCown (1984) and Sprenger (1999) argue that recall is mainly influenced by how new information is integrated with material already stored in long term memory. Thiede & Dunlosky (1999) argue that learner behaviour is the most important factor during and following initial contact with new information. Stewart (1989) states that learner behaviour can be helpful or detrimental to the learning process.

Generative Learning

There is a large body of literature on a form of learner behaviour called generative learning. According to Wittrock (1990), generative learning is an approach whereby learners' consciously employ individualized learning procedures that work well for them. Mnemonics and rhyming are two examples of generative learning strategies that have been found to be very successful for the retention of information over a long period of time (Sinclair, Healy & Bourne, 1997; Smith, 1998). Daily repetition of important information is another strategy for building long-term memory (Carrier & Paschler, 1992; Leiberman and Linn, 1991; Sinclair, Healy & Bourne, 1997; Sprenger, 1999; Zimmerman, 1990). Another strategy used to aid memory is rehearsal. Rehearsal is a deliberate mental process that can result in forming a long-term memory trace, a record or representation of the information (Ashcroft, 1989). Rehearsal can be performed in two ways. Maintenance rehearsal is a low-level repetitive kind of information recycling. Elaborative rehearsal is a more complex type of rehearsal that depends upon the meaning of the information to help store and remember it. Russo, Ward, Geurts, & Scheres (1999) found that changing the environmental context between study and test affected recognition memory. It might be argued that training and testing participants in the same environment might be a type of incidental rehearsal.

Traditional memory research, like Murdock & Kahana's (1993), differs from studies that examine the effect of user control of information to be remembered. Traditional memory studies examined details about list items; where an item was positioned in the list, when did the participant have this item presented and how well the participant remembered details about the list items (Gardiner & Java, 1991; Glenberg, 1984; Murdock & Kahana, 1993). Current psychological research that examines learner interaction with information they are to process usually uses the term self-regulated learning to describe this learner interaction (Thiede & Dunlosky, 1999).

Self-regulated Learning

Thiede & Dunlosky (1999) define self-regulated learning by describing behaviour as a process of reducing the discrepancy between a person's desired state and their current state. The assumption on which they have based their study is that people want to learn certain things and they have a mental framework that helps them achieve their goal.

Thiede & Dunlosky (1999) propose a model for self-regulated learning that includes planning, discrepancy reduction and working memory constraints. They argue that participants regulate their learning by setting a desired goal for learning an item. Participants then monitor how well their learning is progressing and adjust their behaviour with the ultimate goal of learning the material in mind. This is a negative feedback model, as things do not normally change from the plan unless something negative is fed back to the learner. If the learner receives positive feedback, the plan stays unchanged. They speculate that the final phase of this process is that learning stops when the learning goal is reached.

The model presented by Thiede & Dunlosky (1999) is constructivist in nature, and builds upon Zimmermans' (1990) ideas about learner regulation of the learning process. Zimmerman (1990) argued that self-regulated learners pro-actively seek out information and take the necessary steps to master it. Zimmerman (1990) also stated that self-regulating learners view acquisition as a systematic and controllable process. Zimmerman's (1990) work is based on Davey & McBride's (1986) study about the effects of question generation training. Davey & McBride (1986) explored the effects of training in question generation on comprehension question performance. They found the trained group outperformed four different comparison groups. Davey & McBride (1986) also found no interaction between reading skill and treatment group.

Le Ny, Denhiere & Le Taillanter (1972) (as cited in Thiede & Dunlosky, 1999) originally proposed the self-regulated theory that Thiede & Dunlosky (1999) and Zimmerman (1990) based their research on. Le Ny et al., (1972) argued that a person regulates study by setting a desired goal for learning an item, which has been called a norm of study. Thiede & Dunlosky (1999) used Le Ny's (1972) study to help develop their model of self-regulated study.

The original theorist of the "question generation assessment" research, upon which Davey & McBride (1986) based their research into the effects of question-generation on reading comprehension, is Singer (1978). Singer's (1978) study suggested that effective question generation may involve readers in active comprehension.

Davey & McBride (1986) found that people trained in generating good thinking questions about learning material performed better on comprehension tests covering the learning material. Research based on generative learning demonstrated the relationship between the ability to control learning and comprehension of the learning material. Haller, Child and Wahlberg (1988) and King (1992), who emphasized strategies to aid people to control their learning comprehension, studied a further expansion of this relationship. These strategies include self-questioning, self-monitoring and summarizing information. Singer's (1978) study suggested that effective question generation may involve readers in active comprehension. This concept of effective question generation forms the basis of Davey & McBride's (1986) research on the effects of question-generation on reading comprehension.

Construction of Knowledge

Another theory of generative study and generative learning presents the learner as an active constructor of knowledge (Spiegel & Barufaldi, 1994). Spiegel & Barufaldi (1994) argue that student-centered, generative activities are important to learners' recall and retention of information. They found students who actively used generative activities recalled significantly more on a 3-week retention posttest than students who did not use generative activities. These activities include selection of material, analysis of information and interpretation of information.

Thiede & Dunlosky's (1999) research encompasses many of the current theories on self-generation of knowledge. The main points they do not focus on are the previous knowledge the participants have and an imposed structure of knowledge. A study on self-directed learning by Leiberman & Linn (1991) encompasses previous topic knowledge with procedural skills while adding the concept of self-monitoring. This study offers an interesting counterpoint to Thiede & Dunlosky (1999) because of the differences in theoretical and practical ideas. Leiberman & Linn's (1991) study involves previous topic knowledge, which Thiede & Dunlosky (1999) do not emphasize at all. Thiede & Dunlosky (1999) divide previous topic knowledge into sections and have the sections covered piecemeal in their main points regarding self-regulated study. Therefore, until there is more research done regarding previous knowledge, it might be prudent to include multiple ideas about previous knowledge in literature dealing with generation of knowledge.

Presentation of Information

The format in which material is presented to the learner has a great effect on the comprehension and retention levels that the learner experiences (Glenberg, 1984; Healy et al., 1993; Mayer, 1997). Glenberg (1984) discussed to-be-remembered (TBR) information and the differences between visual and auditory presentation in relation to list position of an item. Glenberg (1984) found that auditory memory was stronger than visual memory for the last few list items only. Otherwise, visual presentation provided greater retrieval results for TBR information.

Olsen (1997) examined how auditory stimuli can affect memory without having the content presented in an audio format. Olsen (1997) studied the impact of background stimuli on cognitive functions. Olsen (1997) discovered that background music helped information retention over long interruption intervals of three seconds or more. Background music borrows cognitive functions for short intervals but keeps the learner focused longer. The music also helps process the information through more than one memory path.

Learner Interaction with Information

Another factor to consider when presenting information is the amount of interactivity that is possible between the learner and the material. King (1992) found that generative study is more conducive to learning if learners interact more with the instructional material. This interaction involves what the student does with the instructional material after they have been presented with it. It can be as simple as taking notes in a lecture and reviewing these notes at a later date. It can be a more in-depth interaction involving self-generated learning activities such as those presented by Spiegel & Barufaldi (1994). Stewart (1989) compared the retention results between college students who were presented material in a lecture and the interaction process they used. Stewart (1989) found that students who simply listened scored the lowest on content evaluations while students who took notes did better on the content evaluations. Interestingly, there was no reliable difference between students who took notes and students who took notes and then reviewed those notes before being evaluated on them. Howe (1972) examined a number of studies regarding note taking and suggested that more study was needed on note taking due to the mixed results that existed in the literature.

Organization of Information

The organization of material being presented is also said to be important to learner information retention. Barnett (1984) examined the relationship between the organization of reading content and people with different levels of reading ability. Barnett (1984) argues that a brief explanation about the organization and lay out of material before instruction can facilitate recall of information. People remember material better if they do not have to organize it themselves when they are presented with it for the first time. If material is presented in a familiar pattern, the readers do not have to create a structure for it themselves. They are able to replicate previous patterns, not create a new structure. This allows the reader "to assimilate incoming information into existing knowledge structures and thereby facilitate meaningful learning" (Barnett 1984, p. 11). If material is well organized, it allows skilled readers to profit from the familiar structure. Less skilled readers have to create their own organization and therefore are at a disadvantage. Therefore, providing an organizing structure would appear to support less skilled readers in their recall of information.

There have been studies conducted involving memory and structure of content. An interesting parallel involving familiar structure and recall can be seen between written passages and the game of chess. Gobet & Simon (1996) and Schultetus & Charness (1999) have studied the effect of participants' chess skill level and material organization on memory and recall. Both studies examined the memories of chess players with different skill levels when presented with quasi-random chess positions. Familiarity with the positions allowed the more skilled players to achieve greater recall of typical game positions. There was no significant relationship between skill level and recall of random positions. This recall of information was theorized to be due to the chunking of information (Schultetus & Charness, 1999) that the different skill levels of players were capable of doing. The more skilled players were able to chunk information together more readily than less skilled players due to their previous understanding of the structure involved. The chunking of information gave the skilled chess players an advantage over less skilled players. This is similar to the advantage skilled readers have over less skilled readers. The chunking of information allows the more skilled reader and chess player to assimilate the information more efficiently than less skilled readers and players. This efficiency allows the more skilled people to exert more cognitive effort into other things, like planning the next move in the chess game or benefiting from structured or organized text.

Other important factors when discussing memory and knowledge retention are attitudes and feelings relating to material being presented. Sprenger (1999) argued that emotional memory is the most powerful kind of memory. The emotional response connected to a memory affects how the person feels and behaves. Emotional memory can take over information in what is called "neural hijacking" (Sprenger, p. 54). Neural hijacking is a stress response and it can be a hindrance to a person's ability to learn in a given environment. For example, fear of computers might be a barrier to developing better computer skills. The next section of this chapter further explores the relationship between attitude and computer-based training.

Attitude and Computer Based Training

The concept of attitude is quite a nebulous one; so most studies organize it into more specific categories and subcategories. There does not appear to be a standard approach to defining attitudes toward using a computer. Therefore, it is difficult to compare results from different studies. The variety of categories and subcategories used make it difficult too compare results reliably because the measures might not be measuring the same thing. This leads to some studies that create new attitudinal measures (Liu & Johnson, 1998) while other studies compare the categories and results from different attitudinal measures (Zakrajsek, Waters, Popovich, Craft, & Hampton, 1990).

Attitudinal Measures

Some studies examining the relationship between attitude and computers have three or four categories, while others have fewer categories with many subcategories. Liu & Johnson (1998) chose attitudinal categories including enjoyment, motivation, and freedom from anxiety. Liu & Johnson (1998) also discuss environmental variables like computer access, help and computer requirement. Kay (1993) included measures of computer literacy, computer awareness and perceived control. Violato, Marini, & Hunter (1989) chose a four-factor model of attitude that included sex differences, comfort, liking and value. McInerney et al. (1999) created a Computer Anxiety and Learning Measure to study these variables: 1) gaining initial computing skills, 2) sense of control, 3) computing self-concept, and 4) state anxiety in computing situations.

Zakrajsek et al. (1990) did an interesting study to determine the converging validity of various existing attitudinal measures. The measures included: Zolton and Chapanis' (1982) "General Statements" Questionnaire; Wagman's (1983) Cybernetics Attitude Scale; Popovich, Hyde, Zakrajsek, and Blumer's (1985) Attitudes Toward Computer Usage Scale; Dambrot, Watkins-Malek, Silling, Marshall, and Garver's (1985) Computer Attitude Scale (CATT); Bannon, Marshall, and Fluegal's (1985) Computer Attitude Scale; Nickell and Pinto's (1986) Computer Attitude Scale; and Heinssen, Glass, and Knight's (1987) Computer Anxiety Rating Scale. Zakrajsek et al. (1990) explored the relationship between the preceding attitude measures by administering the studies in booklet form to undergraduate college students who participated in exchange for course credit. The orders of the measures were randomized in the booklets and the booklets were administered to small groups (25 to 50 students) in 30-minute sessions. Zakrajsek et al. (1990) found strong evidence of convergent validity among the measures in the study. There were also findings about the difference between cognitive and affective reactions that participants have to computers. Zakrajsek et al. (1990) suggest the distinction between cognitive and affective reactions to computers should be carefully considered by researchers who will be measuring attitudes in the future as some scales measure one more than the other.

Cotton and McDowell (1990) examined participant attitude about computers viewed solely on the feedback participants receive during and after computer-based instruction. The study attempted to find out what sort of assessment feedback participants' valued most. Cotton and McDowell (1990) found that the value placed on assessment feedback varied depending upon what the assignment was and what other types of feedback the participants had received previously from the computer.

Examination of Computer Literacy

Kay (1993) defines application software skill as the ability to use software, and uses this as an indicator of whether a person is computer literate or not. This is an area of literature that needs to be explored further because many studies were conducted before the widespread introduction of the Internet, current multimedia formats and common use of personal computers. D'Souza (1991), who investigated the instructional benefits of email usage in an undergraduate class, provides an example of this need. This study was groundbreaking as it led to the creation of an attitude measure about email as described in D'Souza (1992). After an examination of the literature, this email measure still appears to be the most used measure about email attitudes yet it was done years before email became the everyday tool that it is now and before email client software made interaction with email more user-friendly. The profound changes in email and email usage in the last decade calls for more study in this area. This is an example of technological advancements outstripping the literature in this area.

According to a 2000 survey conducted by A.C. Nielsen, 61% of all households in Canada in 1999 are connected to the Internet. This percentage increased from 58% in 1998. Multiple ownership of personal computers is up as well as 30% of all Canadian households own more than one computer. According to Rogers (1995), the early majority represents 50% of the population. Therefore, we are now past the stage of the early majority in regards to computer usage. People are now considered computer literate based on their proficiency with computer programs, not computers themselves.

In recent years, the concept of computer literacy has often been explored in research studies (Ayerman et al, 1996; Leh, 1998). This research reviewed how educators define computer literacy. Computer literacy courses at several universities (Ayerman et al., 1996; Leh, 1998) have common educational goals. The common computer concepts and skills students are presented with include word processing, spreadsheets, databases, email and searching on the Internet. These universities, which include Mary Washington College, Arizona State University, Indiana University, Pennsylvania State University and the University of Virginia actually list computer applications that the students will be instructed on. The different universities had different course structures and program requirements, but none of the universities considered knowledge of computer hardware or computer networks to be an essential part of being computer literate. Instead, the ability to competently use a variety of computer programs is what is considered computer literacy at these universities. This is a change from the age of the innovators and the early adopters when computer literacy meant being able to construct one's own hardware and networking solutions.

In 1984, Alberta Education published a definition of computer literacy. Zdunich (1984) listed many computer competencies needed for teachers to be considered computer literate. This list included items on computer programming, the role of the computer in society, computer terminology, computer architecture, and computer hardware &

software. Zdunich (1984) included a 25 question computer literacy test which consisted of 22 programming questions and 3 computer function questions. This report argues that in the age of the early adopters, the early to mid-1980's, people were considered computer literate based on their proficiency with computer software and hardware.

The present study examined participants' ability with one computer program related to their job requirements. This knowledge of a single computer program is a trend in the workplace, as people tend to need to know a specific computer program in order to accomplish their job tasks. In this study, Microsoft Outlook 97 was the productivity software the participants' supervisors felt the employees needed to be able to accomplish their jobs tasks. Examining workplace training may help us to better understand how adults learn when they are extrinsically motivated, intrinsically motivated or both. Singer (1978) argues that the learners' curiosity needs to be engaged in order to aid active comprehension. A better understanding of the motivation to learn a new software program, be it extrinsic or intrinsic, might help designers create a way to better engage the learners' curiosity.

Learner Attitude

Learner attitude is a significant predictor of success with regard to learning about computers and how to use computers (Liu & Johnson, 1998; Zhang & Espinoza, 1998). A few studies (Knezek & Christensen, 1997 & Lui & Johnson, 1998) discuss the idea that a prime motivator for learners was their enjoyment when using the computer. Another important factor in determining the attitudinal scores of participants are the attitudes of people associated with the participant. The attitude of the instructor is a factor that affects student achievement in regards to computer technology. Chiero (1997) attempted to examine teacher attitudes about computers and came up with strategies for limiting obstacles to computer incorporation in the classroom. The attitude of the instructor does not play a role in the present study because there was no person in the traditional role of instructor. Since Chiero (1997) found teacher attitudes affect student achievement, it might be interesting to observe the impact the lack of a teacher has on student achievement.

Another possible influencing factor is co-workers, depending on the social situation. Marcoulides (1995) obtained statistical results that showed a near homogeneity in the police attitudinal results when it came to anxiety about computers. Marcoulides (1995) theorized that the statistical results "suggest the operation of a social norm against admitting to high levels of anxiety about computers" (p. 809). The individualized nature of the present study, along with the low number of participants, might influence participant achievement. In the present study, it will be interesting to see if the participant attitudinal results are homogenous or heterogeneous, especially given the nature of the sample used in the study.

Knezek & Christensen (1997) found that computer anxiety was reduced as people progressed through their computer-based training programs. There was also evidence that, in general, participants came to perceive a more positive role for some aspects of information technology as they progressed through their computer-based training programs. It is worth noting that Kay (1989) found that computer attitude correlated highly with computer literacy, experience and internal locus of control, which leads us to wonder about how great a role each of these factors play in people's attitudes about computers.

Regardless of how attitudes surrounding computers were evaluated, it appears that attitudes have an effect on participant performance. The present study addresses a gap in the literature since there has been very little investigation into computer-based training involving adult participants in the workplace. The majority of computer attitudinal studies used a population consisting of university undergraduate students. These studies, limited by their demographic homogeneity, used a non-random convenience sample as their population. Thus, the studies have limited generalizability to adult populations because participants are very similar in education levels and age.

There have been studies that used a population other than undergraduate students. Studies not using undergraduate students as participants mainly stayed within the educational confines and focused on teachers (Knezek & Christensen, 1990) or grade school students (Shin, Schallert, & Saveyne, 1994). Marcoulides et al. (1995) included a population of non-educators in the workplace, specifically police officers. Marcoulides did include undergraduate students and chose to compare the scores of the police with the scores of the students. Marcoulides (1995) found that "the results of the study indicated that the construct of computer anxiety remained invariant when assessed over a group of law enforcement officers, suggesting that the CAS is capable of measuring the same anxiety constructs for various types of groups." (p. 809). The present study attempts too extend the literature base by shedding light on the attitudes of a diverse group of adult learners in a corporate environment.

Desmarias, Duquette, Renie, & Laurier, (1998) argued that a learners' behaviour in computer-aided instruction is in accordance with the learners' personal representation of learning. They also argued that adults often believe formal and traditional activities are more effective than informal and non-traditional activities. This belief might affect the learners' motivation which Liu & Johnson (1998) defined as a willingness to attempt to do something. Liu & Johnson (1998) also argued that motivation affected performance and therefore, achievement. Desmarais et al. (1998) did show a difference between the adults and the students in attitudes and awareness of their individual progress. These differences might affect motivation and achievement and this would seem to make it difficult to transfer attitudinal results from a population of undergraduate students to a population of adults.

Computer-based Training

Definition of Terms

In the literature, there are many terms used to explain the use of computer technology in instruction. They include:

- computer-aided instruction (CAI)
- computer-assisted learning (CAL)
- computer-mediated education (CME)
- computer-based training (CBT)

- technology-based learning (TBL)
- hypermedia, interactive computer-based education (HICBE)

Computer-based training was the term that fit the best for the method of instruction employed in this study for the following reasons:

- The instruction was entirely computer based.
- It was not aiding, mediating or assisting any other form of instruction.

The word "training" typifies the type of instruction in a workplace environment. By definition, training means practical instruction or drill, as to acquire a skill. The training in this study emphasized acquiring a practical skill with little transfer to other programs. The level of user control was minimal. Training has a passive quality to it, as if a person were an empty vessel to be filled with learning from an outside entity. Much of the literature uses different terms for the same type of instruction on relevant concepts. Therefore, a thorough review of computer-based training will be discussed and expanded upon in the remainder of the review.

Research Design and CBT

There have been many studies that question whether computer based instruction truly enhances student achievement. Fletcher-Flinn & Gravatt (1995) found in their review of literature that there was a significant difference in the quality of instruction between computer-based and traditional instruction. They felt that the typical learning advantage of computer-based over traditional instruction found in most studies could be explained by a difference in instructional quality. They also discovered that few studies use equivalent instructional materials and methods due to the constraints on the research team, thus comparing two different things becomes similar to comparing apples and oranges. These constraints include lack of available equivalent instructional products and lack of time, expertise or both for the research team to create materials that would be equivalent to computer-based materials.

Lansford (1999) investigated whether computer based instruction enhances student achievement. Lansford (1999) studied the effectiveness of computer-aided instruction on the Texas Academic Skills Program (TASP). This study reported conflicting results regarding CAI effectiveness. There was a definite financial justification for using CAI as it was less expensive to have students at computers instead of in front of teachers. The TASP exam results showed no significant difference between CAI and traditional instructor-led courses. This does not show any enhancement of student achievement, only a less expensive option to replace traditional instruction.

There are several reasons why Lansford (1999) believes CAI will be a satisfactory substitute to traditional instruction.

- Students working in CAI will be able to work at convenient times.
- Students taking courses at a distance will not need to commute.
- In CAI students are pretested and a personalized course of study is prescribed for each student.
- In CAI students can work at their own pace.
- In CAI students will spend their time on skills they need to learn.
- In CAI students will have tutorials, practice exercises, and tests over each skill.

Primarily, these are learner control and instructional design concerns. Lansford (1999) argued that the CAI that students used was well designed. Askov & Bixler (1996) argued is not always the case with much of the CAI currently being used. Askov & Bixler (1996) wrote an article about which instructional format, program format and management formats should be used in CAI and which should be avoided. Some CAI lacks pretests, tutorials, diagnostic tools or post-tests. The learner control aspect of Lansford's (1999) argument for why CAI offers a satisfactory substitute for traditional instruction will be covered in more detail later in this chapter.

CBT Revolution

There has been a trend in the literature on computer-based training to consider the computer as a revolution unto itself (Persico, 1997 & Patterson et al. 1997). Lately, the literature is beginning to look at the computer as just a tool (Salaberry, 2000). One overall design of computer-based instruction is not going to be enough for the diversity of people who will be using computer-based instruction in the future. The increased functionality of computers in the last few years is remarkable. For example, in 1983, Alberta Education studied the implementation of microcomputers into an elementary school library (Meyonohk, 1983). This report involved using two 48K microcomputers with 16K RAM cards as electronic card catalogues for staff and students to use to enhance learning. Currently, a blank Microsoft Word 97 document is 19K. This difference in technological requirements is astounding. The revolutionary changes in the capabilities of computers make the findings of many studies practically irrelevant. While the results of the studies are still reliable, there is little of current practical value for educators. More studies need to be done which update findings from previous studies, especially with regard to computer-based training.

To draw an extreme example of a study with little practical relevance today, a study a century ago might have compared the effects of two brands of buggy whips used by carriage drivers on the flow of traffic. The results may be reliable, but not valid as the technology currently being used has progressed well beyond this particular tool. Khalili and Shashaani (1994) did an interesting meta-analysis on the effectiveness of computer applications in improving students' academic achievement. They found that there were significant positive effects on student achievement if the training took place for no less then 3 weeks and no more then 2 months. Before 3 weeks and after 2 months, the achievement levels were significantly lower. As a note about the study, Khalili & Shashaani (1994) stated that a graphical computer interface attracted learners' attention and increased their cognitive learning. Today, a person is hard pressed to find a computer that does not have a graphical interface, let alone someone who uses a text-based interface on a regular basis. An area of the literature that could be further investigated is whether the results of Khalili & Shashaani (1994) study would hold true today if it was repeated using computers with graphical user interfaces and current multimedia capabilities.

Structure of Instruction

The structure of instruction is another area that has come under some scrutiny (Desmarias et al., 1998; Diaz, Aedo, Torra, Miranda, & Martin, 1998; Okolo & Ferretti, 1996; Persico, 1997; and Wild & Quinn, 1998). There are many instructional design concepts that must be addressed in computer-based training. Different studies tend to use different terminology and conceptual frameworks to frame their arguments. Desmarias et al.

(1998) suggest that the age and experience of the users impact navigation and browsing behaviour. When users are initially presented with material, their behaviour is quite erratic as they are in an exploratory mode. As they become more familiar with the material, their behaviour becomes more linear. This parallels the way age appears to affect users; the younger they are, the more erratic the behaviour. Therefore, adults are much more linear in their behaviour involving computers than children. This behaviour was measured by Desmarias et al. (1998) by the observation of learners as they interacted with the instructional program. Adults seemed to take a more systematic approach, including focussing on certain types of tasks.

The difference in behaviour between children and adults might be in part the result of the different motivation in the two groups. Children in a learning environment seem to explore and play, while adults seem to be focused on how to achieve their academic objective with a concern for the time they spend learning. The linear nature of adult behaviour might be representative of the busy nature of the workplace. Adults in the workplace have many tasks to complete and often time becomes a factor in the completion of these tasks. Children have different priorities in their life. Children in school are used to exploring and are often encouraged to spend more time with something that is new or interests them. This allows children the luxury to explore things with less of a focus on time. When children are exploring things, they are learning but it is not always what adults might want or expect them to learn. This would seem to be similar to groups that walk the same distance through the woods. If one group walks quickly and the other group walks slowly and stops to smell the flowers, it would be arguable as to which one has learned more from the walk. If the reason for the walk was to finish, then the quick group achieved this ahead of the slower group. If the reason for the walk was to learn about their companions and flowers, then the slower group might have had more success than the quick group. The effectiveness of the educational experience depends on the motivation and the needs of the learner.

Desmarias et al. (1998) puts forth a six-point framework for creating instructional material that coincides with their six steps of problem solving. These steps include:

- Reading
- Analyzing
- Exploring
- Planning
- Implementing
- Verifying

This six point framework is quite in-depth which is a contrast from more theoretical frameworks like the ones presented by Wild & Quinn (1998) and Diaz et al. (1998).

Wild & Quinn (1998) present a three-point framework, which suggests categories for consideration, including focus on cognitive processes, provision of information resources, and include scaffolded reflection. Diaz et al. (1998) created a Generic Model of Strategy (GMS) which broke the creation process into three parts:

- creating an exercise statement so the learner knows what is to be covered
- management of the program reaction to the learner interactions
- feedback that the learner receives from the program

The literature on instructional design also views the creation of instructional material from the standpoint of implementation. There are a number of checklists and rules of thumb that are meant to help buyers, users or both to choose the instructional material that will be most beneficial to them (Askov & Bixler, 1996; Kaufman, Tesolowski & Roth, 1989). This type of literature typically focuses on the type of instructional activity for which the user wants the computer program. Askov and Bixler (1996) identify seven different formats of computer assisted instruction which they obtained from Alessi & Trollip (1985). These formats are:

- tutorial
- simulation
- assessment
- demonstration/presentation
- drill & practice
- learning games
- problem solving

Lists like this allow less experienced users the opportunity to determine exactly what they plan to use the instructional software for. For example, a tutorial may be better than drill and practice if the goal is understanding a new concept in math versus learning a list of spelling words.

Learner Control and CBT

Learner control is an important theme in the literature. Most studies agree learner control is vital to the creation of knowledge (Clariana, Ross & Morrison, 1991; Diaz et al. 1998; Lee & Lee, 1991; Shin, Schallert & Saverge, 1994; Stanton & Stammers, 1990). Learner control involves the amount of interaction and choice that is possible between the user and the content provided by the computer program. Concepts associated with control of learning include pacing of instruction, generation of knowledge cues, and format of feedback. Computer-assisted learning often, but not always as is the case with PLS, assumes learners are the best judges of their learning needs.

Learner control ties directly to recall and retention of information. The amount of learner control affects the learners' generative learning (Kinzie, Sullivan, & Berdel, 1992). Learners create individualized learning procedures that work well for them. A limit on learner control could also limit the learners' interaction with the material and was found to be contrary to generative learning (King, 1992). King (1992) argues that the greater degree of learner control, the more opportunity the learner gets to choose what recall and retention activities work best for them.

Lee & Lee (1991) presented an argument comparing learner control and program control. They argued that the level of previous learner knowledge was the deciding factor for what is the appropriate style for the instructional program. Lee & Lee (1991) found that the greater the amount of previous knowledge, the greater the advantages of learner control. The logical continuation of this thought is the less previous knowledge a learner has, the greater the advantages of more program control. Shin, Schallert & Saverge (1994) found that the results of learner control and previous knowledge studies were not as clear cut as the Lee & Lee (1991) study. Shin, Schallert & Saverge (1994) found many factors that could affect the results of Lee & Lee's (1991) study. These factors include attitude of the learners, age, experience navigating in a computer application and the amount of advisement in the instructional application.

Feedback in CBT

Feedback is the final concept to be discussed in this review. Clariana, Ross & Morrison (1991) found that it is very important for learners get feedback of some kind during their instructional session. There are "significant benefits" to the user for even a minimal amount of feedback over no feedback at all (Clariana et al, 1991). Feedback in computer-based training has many different variables that need to be presented. The variables include time, adaptiveness, generation, purpose and structure. In the past, feedback in instructional programs was often just the score on the final test.

Currently, feedback in computer-based training has a number of variables. The variable of time deals with when the user receives feedback. The user can receive feedback during instruction, after instruction, during evaluation and after evaluation. There is also the possibility to receive time-delayed feedback to allow the user to think about the question that triggered the feedback. Kulik & Kulik (1988) concluded that feedback immediately after user response was best for most instructional situations. In a situation where test questions were used as instruction, then delayed feedback worked best.

Feedback can be generated by more than the program. It is possible for the learner to create his or her own feedback. Learners can use self-generated categories and comments to make the feedback more relevant for them. By making the memory feedback cues distinctive and compatible to their own memory trace, learners improve their ability to remember and comprehend information (Davey & McBride, 1986; and Baeckman & Mantyla, 1988).

The purpose of feedback is another important variable. Evaluative feedback can be as simple as a correct or incorrect message. It may include statistics regarding the number of correct versus incorrect responses or other quantitative data such as the time it took to complete the training. If the purpose of the feedback is instructional, then explanations and greater detailed information may be provided. Instructional feedback might also lead to further questions or data to allow the learner to explore a topic of interest or review a topic of difficulty for the learner.

The detail that feedback presents can be quite diverse. Depending on the learner and the nature of the feedback, it can range from minimal to verbose. Detail dovetails with the structure of the feedback. Qualitative and quantitative feedback require different structures, as do instructional and evaluative feedback.

One of the strengths of computer-based training is the possibility for adaptive feedback. Straetmans & Eggen (1998) examined computerized adaptive testing and Item Response Theory. Item Response Theory allows the computer program to have knowledge benchmarks. The program assumes that if the learner can answer a question correctly, then the learner can answer all the previous questions correctly. The program skips questions when it gives the test to the learner. When the learner answers a question incorrectly, the program skips back in the question list. This skipping back allows the learner to answer a previously unanswered question. One example is a person completing a computerized adaptive test who is asked every fourth question. The person answers Questions one, five and nine correctly before incorrectly answering Question 13. The program then skips back to ask a question between the last correct question (nine) and the incorrect question (13). In this case Question 11 is the middle question and the person answers it incorrectly. The program then repeats the skip back process to come up with Question 10 because it is between the last correct question (nine) and the last incorrect question (11). If the person answers Question 10 correctly, then their level of mastery of the material will be at the level of Question 10. This adaptiveness is a time saving as it allows the program to determine the level of mastery in seven questions instead of 10. The larger the skip interval and the farther along in the test a person progresses, the more efficient the testing process. If the person answered Question 13 correctly, they would not have been presented with Questions 10, 11 and 12. This is an example of adaptive instructional feedback that could work well with the current computer technology.

The main benefits of adaptive testing are test difficulty, test length and question security. An adaptive test adapts itself to the ability of each person taking the test. Therefore each test has an individualized difficulty level rather than a generic difficulty targeted at the average ability level of people in the test group. Adaptive testing allows a person to answer fewer test questions, thus allowing the test to be completed in less time. It also helps improve the security of the test because each person takes a different test. Other advantages of computer-based adaptive testing include on demand test delivery, computer-based test marking, and the ability to include multimedia materials (audio and video files) to make the test tasks more like real-life tasks.

With all the possible advantages of adaptive testing, including test difficulty, test length and question security, this study did not use adaptive testing. For the purpose of this study, knowledge retention will be measured by assessing participants' scores on a test given at 4 different times over a period of 60 days. This evaluation tool is made up of knowledge questions. These questions are at the knowledge processing level as Bloom defined knowledge in his taxonomy of instructional objectives (Bloom, 1956). The testing procedures and materials will be discussed in greater detail in the Method and Discussion chapters of this thesis.

Conclusion

From the literature review on knowledge retention and computer-based training, a gap was identified in the current research literature on instructional design to increase knowledge retention in technology-based instruction (Caple, 1996; Fletcher-Flinn & Gravatt, 1995; and Straetmans & Eggen, 1998). Determining the long-term effects of instructionally designed and learner designed knowledge retention activities may provide useful information for future instructional program designs. Many studies are knowledge retention studies or computer studies; few are both. There is a definite need to explore these issues together, as the trend toward more computer-based training continues (Caple, 1996).

In the present study, three conditions of knowledge retention activities were examined. The first condition was "unrequested retention activities" that users did on their own without any prompting from researchers. The second condition was retention activities that the users completed on their own after being asked by the researchers to generate their own review schedule and questions. The third condition was computer generated knowledge retention activities the users completed. The three groups were instructed in the usage of the same computer program and given the same evaluative tools over the same period of time.

Judging by the present research literature on computer-based training, the present study should contribute to present understanding and knowledge because it examines attitudes over an extended period. More studies are needed to explore the evolution of attitudes about computers over an extended period of time.

CHAPTER 3

METHOD

This chapter describes the research design, training sessions, testing procedures, materials and the data collection procedures used in the present study. This chapter concludes with a description of the sample along with the materials used by the participants.

Overview

The purpose of this study was to evaluate the effectiveness of knowledge retention activities and computer-based training for learning about a computer application. The participants were adult employees of a multinational company who learned Microsoft Outlook 97. The design of this study was a quasi-experimental and used a convenience sample with a pretest-posttest control group. The study involved random assignment of participants into one of three groups and providing training in portions of Microsoft Outlook 97, a workgroup and individual desktop information management program, which will be described in greater detail in a subsequent section. After training, each group completed a different regime of knowledge retention activities. The investigator administered the same content test on four occasions to measure knowledge retention among the groups. The testing occurred before training, directly after training, 30 days after training and 60 days after training. The initial training took place in mid-June in a university computer lab. The knowledge retention and testing portions of the study took place at the downtown company offices and on the Internet over the 60 days (July and August) following training. See Figure 3.1 for a diagram of the research procedure.

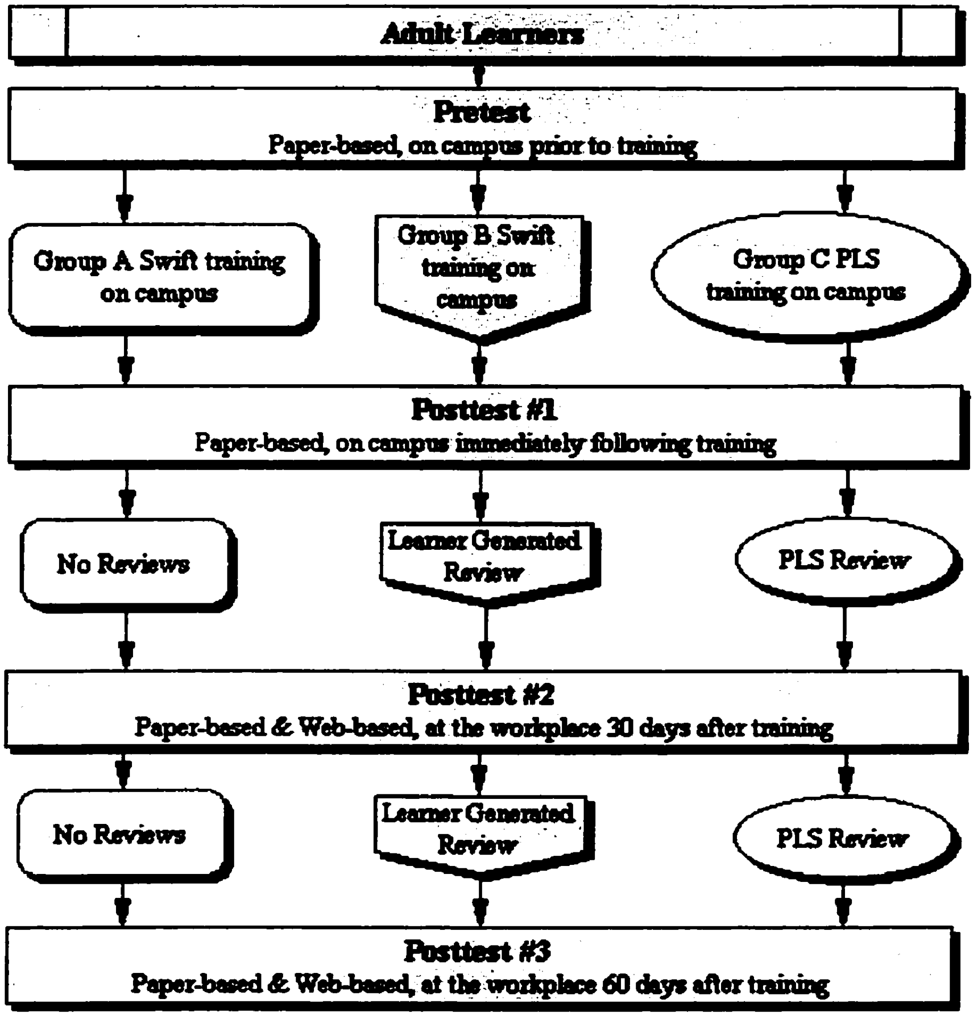


Figure 3.1 – Method map of research design

Procedure

The study involved participants who completed training in portions of Microsoft Outlook 97, and then took a the content evaluation test (Appendix A) on different occasions. The test items were the same for each administration, which allowed the test to act as a review constant. The pretest was carried out before the participants received any training. The second evaluation was done on the same day directly after the training session. The third evaluation occurred approximately 30 days after the initial training session and the final evaluation came approximately 60 days after the initial training session.

Organization of Training

Training was done over three days at a university computer lab, with individual participants spending only one day at the lab. The participants traveled to the computer lab, were given lunch, and stayed until the training and posttest was complete. Since the training and the posttest were self-paced, the participants stayed between 4 and 7 hours depending on the pace of the participant. The participants were randomly split into three groups: group A, group B and group C. Groups A and B used an instructional computer program called SWIFT, which will be described in a subsequent section. Group C employed a program called the Profound Learning System, which will also be described in a subsequent section. Even though there were 25 computers in the lab, the scheduling process limited the number of daily participants from a maximum of 17 and a minimum of 12. Approximately one third of each group receiving training during any given day. Each participant was assigned a password and user ID. Only the primary researcher had access to the list of passwords and user IDs.

The vice-president of Profound Learning Systems helped participants with any technical problems they had with either system during the training sessions. The vice-president is the same person who did the demonstrations and introductory explanations for the participants before the training began.

Training was a full day session on campus to learn how to use the computer program Microsoft Outlook 97. To ensure that each participant could complete the entire training session in a single day, the calendar and email functions of Microsoft Outlook 97 were omitted from the training. Participants were told they would be given the opportunity to take training on these two functions after the completion of the research study. Training days started at 9:00 a.m. in the computer lab with a brief introduction of the organizational team involved in the research study. The participants were thanked for their participation in this research project. An explanation of the logistics of the study emphasized the self-paced instruction and the 9:00 a.m. to 4:00 p.m. time frame of the training day. The participants were allowed discretionary coffee breaks. There was one officially scheduled break in the morning, but the afternoon break was totally unstructured.

The delivery format of the test changed several times prior to implementation. Initially, it was decided that the researcher would administer a pencil and paper test. After discussions, this procedure was changed to evaluations and surveys posted to the Internet. Finally, it was altered again to employ self-marking evaluations that would be completed using WebCT. Due to limitations in time and the functionality of WebCT, the evaluations and surveys were then to be completed in Microsoft FrontPage 2000. In FrontPage 2000, it is possible to submit the data directly into a Microsoft Oracle 2000 database. Due to technical problems, this did not work. For the training sessions, the evaluations and surveys were administered using pencil and paper documents hand scored by the researcher. By the time of the post 30 day evaluations, participants could choose from the material which was available in two delivery formats, which were a paper-based test and a web-based test. The majority of the participants chose the traditional pencil and paper documents. A few participants chose to complete the online evaluation and survey. The online material was a web-based form that was created in HTML code by the researcher. This form sent the submitted data to a text file the researcher hand scored. Each participant also printed a copy of the online evaluation and survey before they submitted it in case of a technical problem. An independent reviewer who had no other contact with the study evaluated the hand scored documents and later assured that the evaluations were marked accurately according to the answer key that was provided by Profound Learning Systems.

The participants filled out three surveys. The first survey entitled, "Pre-Training Survey" (Appendix B) was completed just before the participants did the pretest. After training, the participants completed an anonymous comment sheet (Appendix C). The participants completed the final survey entitled, "Post-training Survey" (Appendix D) just before they completed the 30 day test.

The research study was described to the participants prior to their signing of consent forms (Appendix E). The participants were assured that the individual results would be kept confidential and only group results would be reported in the study. The participants were also told their employer would not find out the scores of the evaluations. This procedure was an active attempt to reduce anxiety about training performance being linked to evaluations of job performance. This anonymity meant people could drop out of the study without repercussions at their workplace. All participants were asked not to discuss the research project with anyone else in the study until the post 60 day evaluations were completed. Because there were differences in the follow up activities, this was an attempt to control the evaluation data for error. Participants were allowed to pick whatever computer they wanted for their training. The computers had wooden, swiveling chairs. The chairs by the tables were plastic. Participants were free to exchange chairs as they saw fit throughout the training session. The uncomfortable chairs was one of the major complaints made by the participants about the training session.

When the introduction was finished, Group C was separated from Groups A and B. Group C was taken to another room and given a demonstration and an explanation of the Profound Learning System by the vice-president of Profound Learning Systems. When the demonstration and explanation was finished, Group C was given the pre-training survey and then the pretest by the researcher. While Group C was out of the computer lab, Groups A and B were given the pre-training survey and the pretest by the researcher. When Groups A and B had completed the survey and pretest, the SWIFT computer program was demonstrated and explained to them by the vice-president of Profound Learning Systems. Group C completed the pre-training survey and the pretest after the program demonstration and Groups A and B completed the pre-training survey and the pretest before the program demonstration because the vice-president of Profound Learning Systems was the person doing the demonstration of both computer programs.

This procedure, which involved separating the groups and the different order of events presented by the vice-president of Profound Learning Systems, might have led to a Hawthorne Effect (Gottfredson, 1996; Jones, 1992) due to the possible participant belief that one group is receiving different (and perhaps preferable) treatment than the rest of the participants in the study.

After the three groups took a brief break together, everyone returned to the computer lab by 10:20 a.m. to start the training on Microsoft Outlook 97. Both instructional programs allowed learners control of how quickly they would progress through the instructional material. Participants took a lunch break of approximately 30 to 60 minutes at a location of each individuals choice. Lunch was provided in the lab, and everyone chose to stay in the lab rather than leave for a meal. When one participant went back to the training program, the participants followed this example and continued on with the training without any prompting from the research team. The participants finished the training programs at various times in the afternoon, ranging from 12:30 until 3:35. After the training was complete, each person arranged a time to do the 30 and 60 day post treatment evaluations with the primary researcher. When the scheduling was completed, each participant was given an anonymous comment sheet and the first posttest. After the posttest was submitted to the researcher, the participant left the training lab with post training follow up instructions.

The two SWIFT groups, A and B, went through the same training. The difference in each group came after the content acquisition (training) phase was complete. Each group was given a different set of instructions as a follow-up to the content acquisition as to what they were to do with regard to the study for the 60 days following the training. This was called the retention phase of the experiment. Group A (Appendix F) was thanked for their participation and asked to take the post tests at 30 and 60 days following the training day. Group B (Appendix G) was thanked for their participation and asked to take the post tests at 30 and 60 days following the training day. Group B was also instructed to independently review the SWIFT program for approximately 5 minutes a day for the length of the study. This group was given a CD-ROM with the SWIFT program on it and instructions on how to install it onto their computers at home or at their work place. Group C used the Profound Learning System (PLSystem). They were given instructions (Appendix H) to log in to the PLSystem for the retention questions that the program would generate each day. These retention questions were programmed to take approximately 5 minutes each day. Every participant received a thank you by email for taking part in the research study the day after they went through the training.

Posttest Evaluations

Eleven days before the post 30 day evaluation, every participant was sent an email reminder of the date and time they had agreed to for post testing. A large number of the participants needed to change their scheduled posttest appointments due to conflicts with other work commitments. These commitments included meetings, vacation time and work that were more important to them than the research study. Many of the time conflicts resulted in participant withdrawal from the study that will be described in detail in the next section.

Participants

The participants of this study were a convenience sample. All were employees of a multinational oil and gas company that has an office in a city in western Canada. All employees were invited to participate in a study that involved a training session and two post training evaluation sessions, at 30 and 60 days after the initial training session. The volunteers were given no incentive to participate in this study other than to allow them the opportunity to engage in some free organized computer software training.

Management considered the material presented in the content acquisition phase of this study to be advantageous to employees for their present job tasks. It was hoped that the inherent advantages of additional training would be a motivator for individuals to participate in this study. Participants were also provided with a lunch given that they traveled to campus to participate in the study.

The study initially started with 68 people who volunteered for the training sessions although only forty-two people arrived at the training site. When the training was completed, forty-two participants had been trained and had scheduled the post 30 and post 60 day evaluations. The post 30 day evaluations were eventually spread over seven different dates when the researcher went to the company offices to personally oversee the evaluations. The dates were spread out due to scheduling problems. Rather than exactly

30 days after training, the dates ranged from 23 to 42 days after the training sessions. Some participants were unable to accommodate these dates into their schedules. Several participants were being transferred and others came to the city just for this training from places quite some distance from the training area. These participants requested that the post evaluations and surveys be posted on the Internet so that they could be completed when the participants had free time in their schedules. By the end of the post 30 day evaluations, seven participants had dropped out of the study. This left 35 participants for the post 60 day evaluations.

The post 60 day evaluations were spread over 5 different dates to accommodate the schedules of the participants. As with the post 30 day evaluations, the post 60 day evaluations were not exactly 60 days after the training was finished. The dates ranged from 56 to 71 days after the training sessions. The post 60 day evaluation was also posted to the Internet for the participants who were unable to come to the downtown meeting room at the time the post 60 day evaluations were done. By the end of the study, 32 participants remained as 3 had dropped out between the 30 and 60 day posttests.

Materials

Pre-Training Survey

The pre-training survey (Appendix B) was designed to measure existing attitudes that participants had about computers. The pre-training survey also gathered demographic data from participants, such as information about previous experience with computers, accessibility of computers, computer usage, age and gender. Kay's (1989) Affective

Scale was used to gather information about participants feelings about computers using a ten question index based on a five point semantic differential scale. The computer attitude measure (CAM) index of the survey was from Kay (1993). The Cam consists of 10 questions about typical and atypical user behaviour involving computers. It is a 5 point Likert scale which has scores ranging from 1) Extremely Likely to 5) Extremely Unlikely.

Final Survey

The final survey (Appendix D) was given to participants just before they received the post 30 day evaluation. The Computer Attitude Questionnaire (CAQ) (Knezek & Miyashita, 1993) consists of a twelve-question index based on a 5 point Likert scale. The CAQ gathered information about attitudes on computer importance, computer enjoyment, computer anxiety and computer seclusion. It has scores ranging from Strongly Agree (SA scored 1), Agree (A scored 2), Undecided (U scored 3), Disagree (D scored 4) and Strongly Disagree (SD scored 5). The survey also asked the participants to estimate how much they had reviewed the material since the training session. The review question had scores ranging from never to every day.

Questionnaire

The second survey was a questionnaire given when the participant had completed the training and had not yet done the post training evaluation. This survey was an anonymous comment sheet which asked only for the instructional program that the participant had worked on and any comments the participants had about the program or the training. To assure anonymity, the participants did not return the comment sheets to the researcher. There was a box on the table near the exit and the participants put the sheets in the box so that no one could connect the sheets with a particular person.

Content Evaluation Test

The content evaluation test was provided by Profound Learning Systems and consisted of 100 knowledge level questions (Bloom, 1956) about Microsoft Outlook 97. In addition to the 100 content questions, the research team added 100 confidence questions. Each content question was matched with a confidence question to measure participant's confidence in their response to each content question. Each content question was worth one point making the test 100 points. The confidence questions were not scored as part of the test. The test was divided into 3 types of questions. There were 77 true or false questions, 7 multiple choice questions with one correct answer and 16 multiple choice questions with possibly more than one right answer. For the 16 multiple choice questions, participants were asked to choose every correct answer for the question. The number of correct answers varied from one, two or three answers per question. To satisfactorily answer a question, the participants needed to get the all the correct answers for each question. If they chose two correct answers out of the four choices, but there were three correct choices, then the participant did not answer the question satisfactorily.

Data Analysis Software

The statistical software package SPSS 10.0 for Windows (SPSS Inc., 2000) was used to perform the descriptive data analysis.

Profound Learning System

The Profound Learning System (Profound Learning Systems Inc., 1999-2000); is an Internet-based instructional software program designed to individualize content retention activities after an instructional session ends (see Figure 3.1). The program uses audio, text, video, and still graphics in the instructional portion of the program. The PLSystem includes the functionality to launch the target program the user is being taught about.

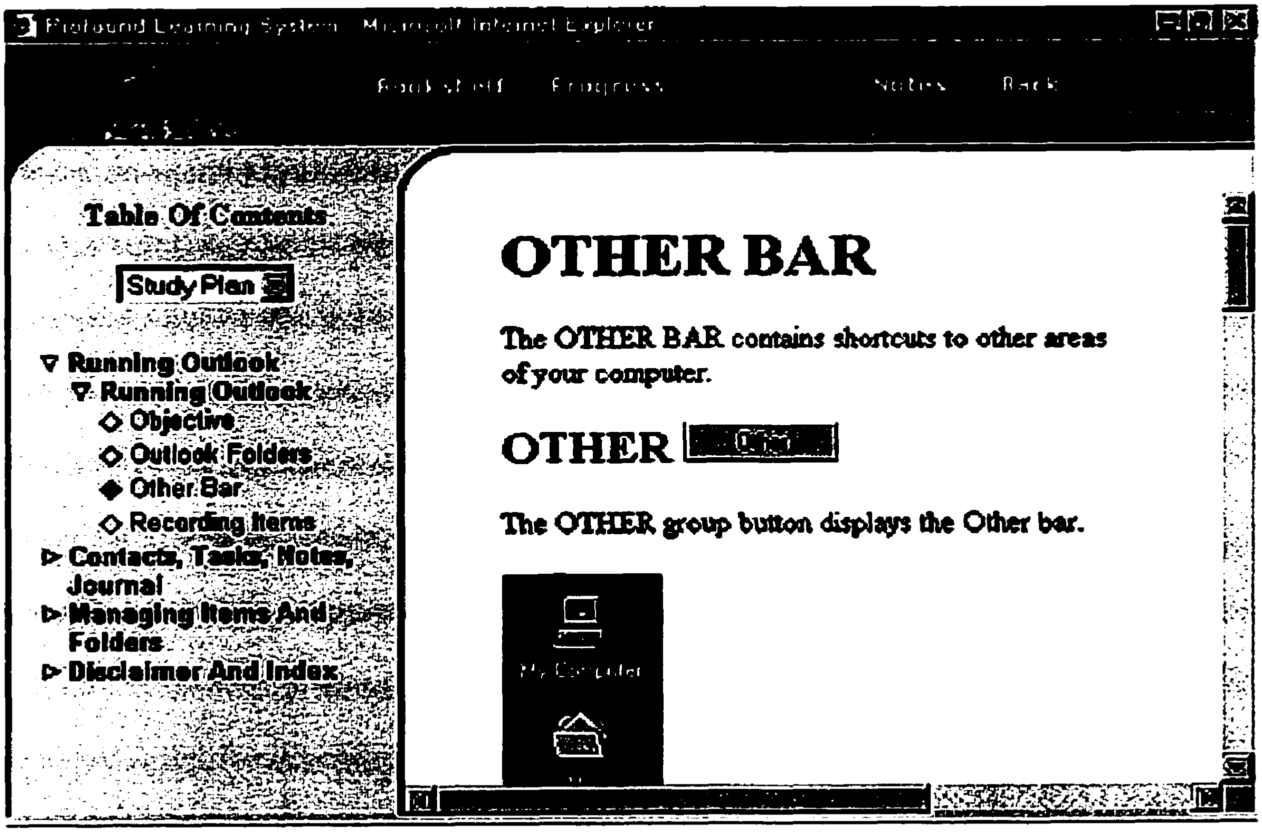


Figure 3.2 - The Profound Learning System Sample Page

PLS has a six button program navigation system that is always present at the top of the window when people are logged onto the program. There is a second navigation system that is evident as people take their training, which is down the left-hand side of the screen and consists of the table of contents. The table of contents is expandable and can display headings and sub-headings of the content in the program. A colour coding system shows the user the current content area.

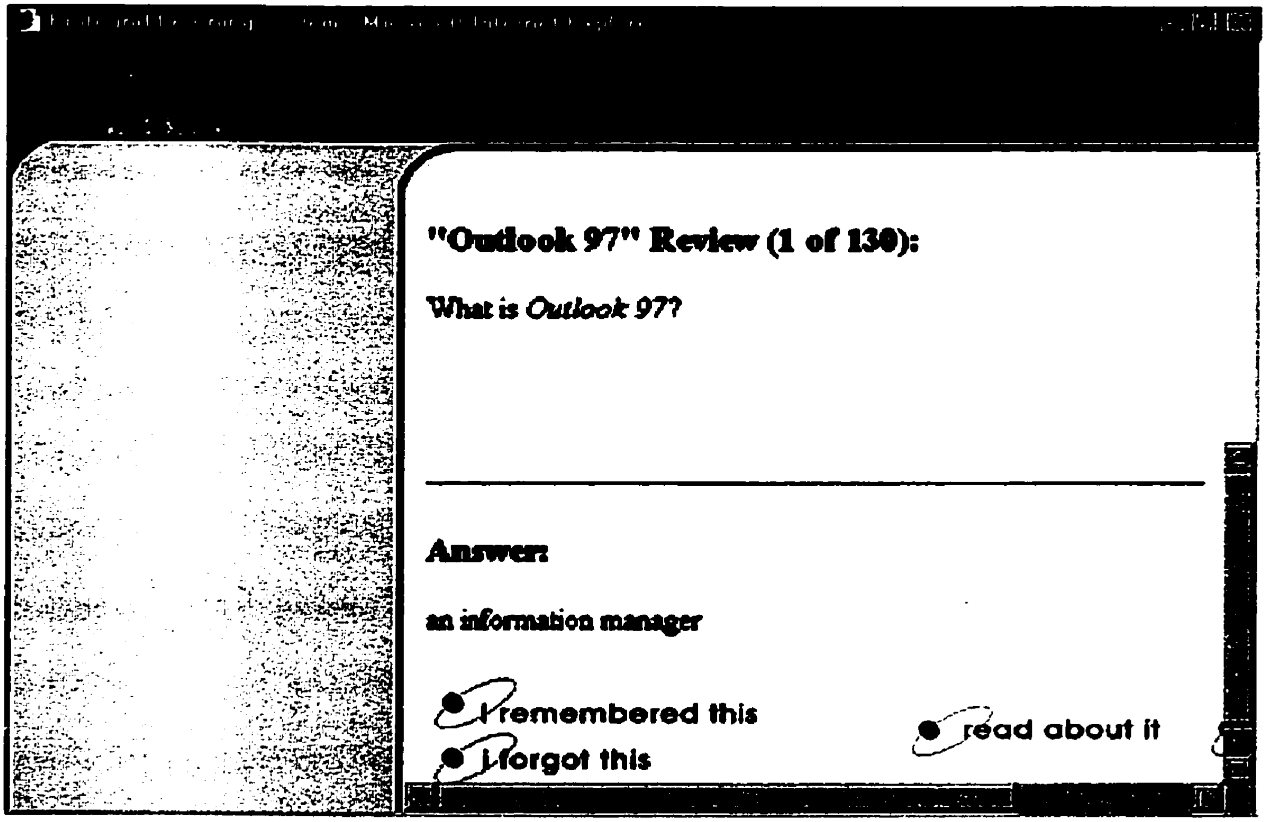


Figure 3.3 - The Profound Learning Engine

The retention aspect of the program is run by the Profound Learning Engine (PLEngine), which modifies the retention activities and provides feedback to the learner about their achievement based on a maintenance rehearsal model of information recycling. The PLEngine requires the user to log into the program on a daily basis to answer retention questions about instructional material presented at the training session. With this log on, user performance is recorded to track the learning rate for each user. The program screen is split horizontally with the review question in the top section and the answer in the bottom section (See Figure 3.2). The bottom section also includes interactive options for the learner. If the user chooses "I remembered this", that is considered a correct score on the review question. If the user chooses "I forgot this", that is considered an incorrect score on the review question. The user may also chose the "read about it" option. This causes a pop up window to appear with the same information that was presented to the user when they went through the instructional aspect of the training session. There is a fourth option in the retention aspect of the program. "Quit Review" allows the user to end the current review. Any review questions that were scheduled to be answered will automatically be added to the review queue. If the user comes back to the review aspect of the program that day, the remaining questions in the queue will be presented to the user. If the user logs in the next day, then more questions are added to the queue so the user gets the new questions plus the questions that were left from the previous day.

The PLS summarizes the progress of the user on the Knowledge Retention Progress page (See Table 3.1).

Table 3.1 - PLS Summary of Learner Progress

Knowledge Retention	
Ebook	Outlook 97
Current Learning Rate	90%
Date of Last Review	2000-08-23
Total Number of Questions to Review	174
Number of questions for review today (advanced)	109
Estimated time to complete today's review	14 minutes, 32 seconds

This progress page includes information about six variables in the program. The first of which is the course that is being reviewed, called the eBook. There are also details on the percentage of times the user chose "I remember this", the number of questions to be reviewed and a time estimate for how long it should take to complete the scheduled review. This progress page provides all the feedback the PLS users received during the knowledge retention portion of the study.

Group C used the PLSystem program in the content acquisition and retention phases of the research study. PLSystem is an Internet based instructional program, therefore a computer with an Internet connection is required to use this program. Each learner had to progress through the training covering the same material. The learners controlled the speed in which they progressed through the instructional material. This allowed the participants to pace their learning to match their individual needs and abilities. There was little else in the way of user control in the PLSystem. The review activities were strictly controlled by the PLEngine so there was no way participants could control the activities they would do or the topics they would review. According to Clariana, Ross & Morrison (1991), Diaz et al. (1998), Lee & Lee (1991), Shin, Schallert & Saverge (1994), and Stanton & Stammers (1990), learner control is vital to the creation of knowledge. Learner control involves the amount of interaction and choice that is possible between the user and the content provided by the computer program. Therefore the lack of interaction and choice the Profound Learning System seems to be in direct contrast to the principles of learner control and the creation of knowledge. King (1992), Spiegel & Barufaldi (1994), and Stewart (1989) all found that generative study is more conducive to learning if there is learner controlled interaction between the learner and the instructional material. The program controlled nature of the Profound Learning System makes the assumption that the program knows more than the learner about what is best instructionally for the learner. Lee & Lee (1991) found that this was the case only when learners had little previous knowledge about the instructional material. This assumption that the program knows what is best for the learner could be a drawback as learners acquire knowledge and progress through the instructional program

SWIFT (SoftWare Intelligent Freeform Training)

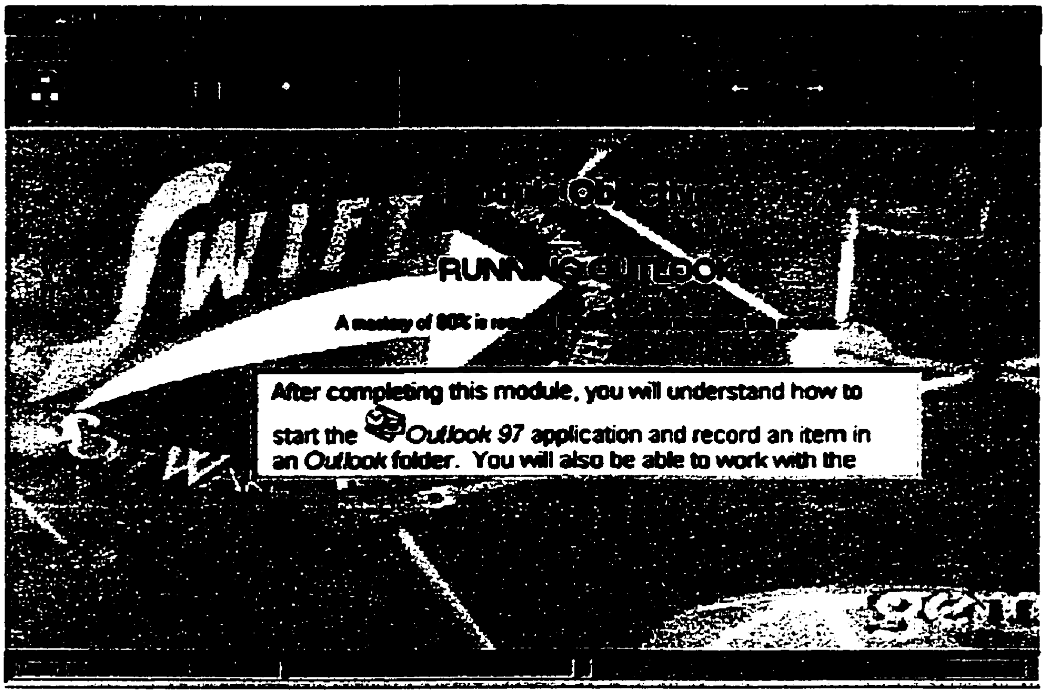


Figure 3.4 - SWIFT (SoftWare Intelligent Freeform Training) Introduction Screen

The SWIFT program (Gemini Learning Systems Inc., 1990-1999) is a CD-ROM based instructional software program designed with an interactive Adaptive Learning Environment (ALE). This program was used in the instructional and retention phases of the research study by Groups A & B. The program uses video, audio, animation, text, and links to external applications to present the instructional content, in this case content on Microsoft Outlook 97 to the user. SWIFT uses an adaptive testing algorithm that shortens testing time while determining the learners mastery or non-mastery of the course. SWIFT's adaptive testing is based on the concepts examined by Straetmans & Eggen (1998). With SWIFT, the program needs to be installed on the computer with the CD-ROM in the CD-ROM drive.

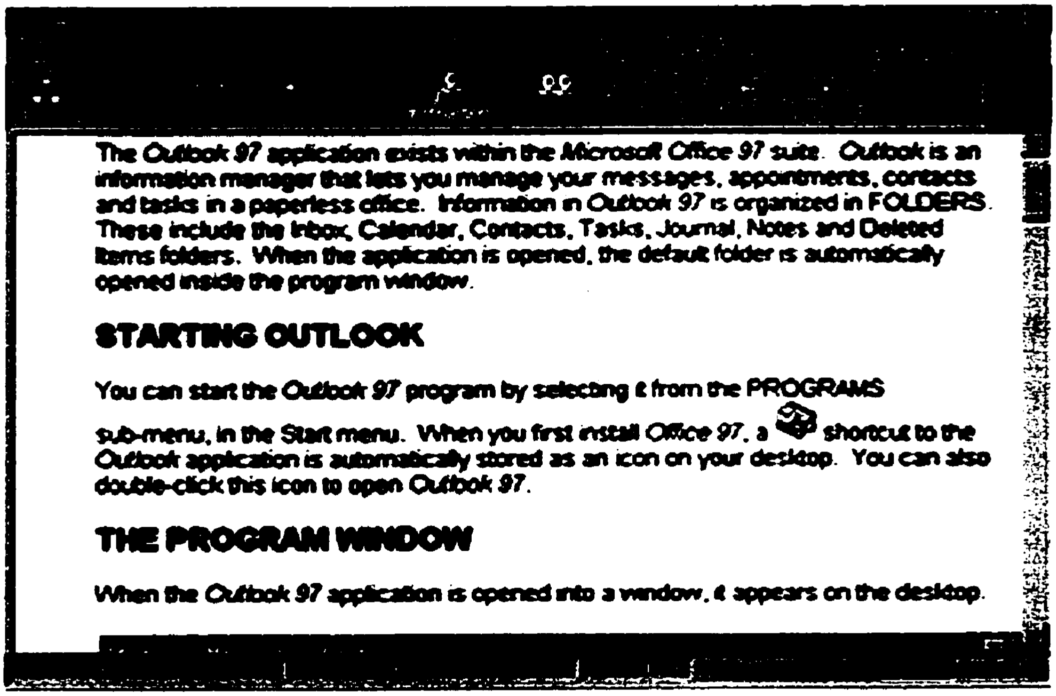


Figure 3.5 - SWIFT Instructional Screen

The SWIFT program has module pretests, exercises, quizzes, module posttests, and a course posttest that were disabled for this study. In the full version of SWIFT, whenever a learner reaches a preset point, an evaluation will test them on the content. Since these evaluations were not built into PLS, it was felt that they would give the groups using the SWIFT program an advantage over the PLS group. While using the SWIFT program, each learner has to progress through the training covering the same material. The learners were able to progress at their own speed. SWIFT can track and record the learner's navigation through their course, allow them to review their path, go back to any location, or access guidance if desired. This information is stored and available through the Enterprise Learning Manager (ELM). The ELM provides a graphical Course Map that can be turned on or off as the learner progresses through their course. The map displays the learner's progress and provides navigation to go directly to any topic of interest, view a video or do an exercise. This allowed the participants to pace their learning to match their individual needs and abilities.

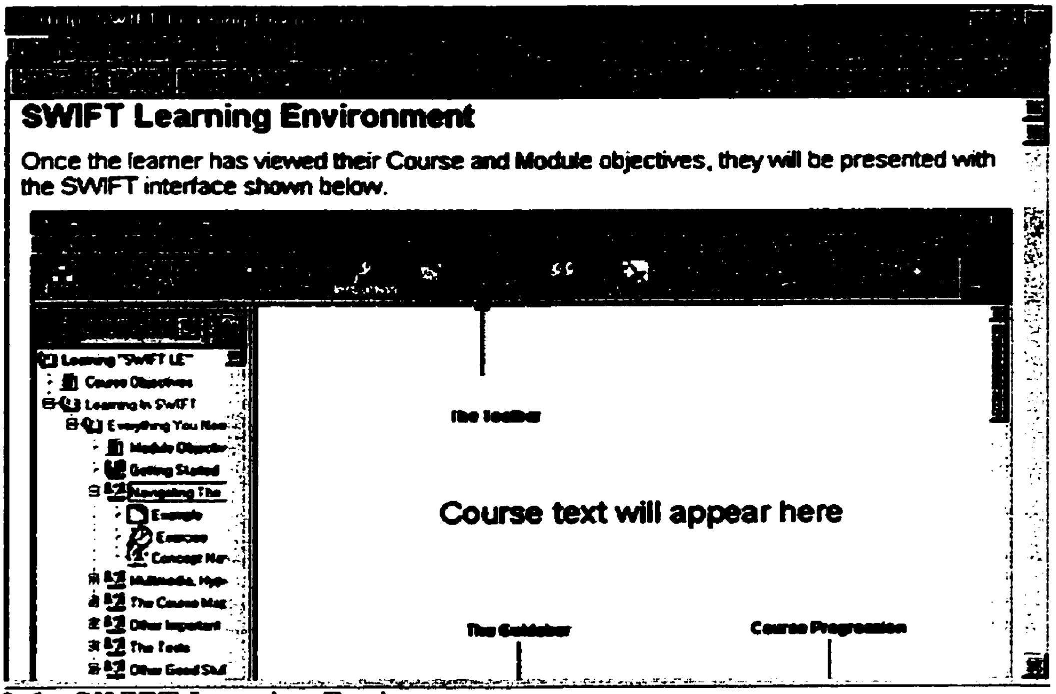


Figure 3.6 - SWIFT Learning Environment

There are many similarities between the PLS and the SWIFT programs used in this study. Both programs have text, audio and graphical aspects to their presentation of information. Both programs have a modular adaptive component to them where people insert the instructional content to be learned. This adaptability allows learners to study different instructional content (modules) depending what they have purchased or have been given access to. In this study, the instructional content was the same in both programs. SWIFT and PLS allow users to have control over the pace in which instructional content is presented. The self-pacing allows learners to match their individual learning needs.

There is also a built-in test in both programs but the format of the testing is one of the main differences in these programs.

The review activities in SWIFT were controlled by the participant so participants could control the activities they would do or the topics they would review. According to Clariana, Ross & Morrison (1991), Diaz et al. (1998), Lee & Lee (1991), Shin, Schallert & Saverge (1994), and Stanton & Stammers (1990), learner control is vital to the creation of knowledge. Learner control involves the amount of interaction and choice that is possible between the user and the content provided by the computer program. Therefore the interaction and choice provided an opportunity for the participants to have total control over their review activities in SWIFT which goes along with the principles of learner control and the creation of knowledge.

The testing process in the SWIFT program consists of end of unit exams covering the instructional material presented in the unit. The Profound Learning System has knowledge retention evaluations, which are much smaller and more frequent, then the SWIFT unit tests. There is also a difference between the programs in regard to the accessibility of the program. The Profound Learning System is Internet-based, so a computer with an Internet connection is needed to operate the system. This leads to implementation issues including: Internet connection speeds, server maintenance, having the users remember the web address to the Internet site or bookmarking the site. SWIFT is a CD-ROM based program which requires a computer with a CD-ROM drive and hard drive space. SWIFT needs to be loaded onto a computer to be used but if more then one computer is used, it limits the usefulness of the ELM. The ELM can only track progress through the program on one computer. Starting on a new computer causes the ELM to start the learner from the beginning of the program. This ELM tracking procedure forced SWIFT users to be responsible for tracking their own learning if they used it on more than one computer.

There was a lack of possible learner feedback with the way SWIFT was used in this study. This lack of feedback reduced the opportunity for "significant benefits" to the user for even a minimal amount of feedback over no feedback at all (Clariana et al, 1991). The disabled module pretests, exercises, quizzes, module posttests, and course posttest limited the amount of possible feedback the user could receive during training. Even though Clariana et al. (1991) found that it is very important for learners get feedback of some kind during their instructional session, there was no structured feedback mechanism in place for the retention portion of the study as SWIFT was not designed to be reviewed over time, especially without it's disabled sections.

Microsoft Outlook 97

Microsoft Outlook 97 was the program used for the content acquisition and retention phases of the research study. MS Outlook 97 is an individual and workgroup desktop information management program. The MS Outlook 97 desktop information manager has the following capabilities: Electronic mail, Personal calendar and Group Scheduling, Personal information such as contacts and tasks, Custom collaboration and informationsharing applications. Outlook helps users organize, find and view all of this information — all in one place — using a consistent interface.

Microsoft Outlook 97 was newly installed on the computers in the lab with the default viewing settings. The default settings created a uniform look for the program in the lab. A concern regarding the viewing uniformity in the environments where participants did their retention activities will be discussed in Chapter Five.

Computers

The training sessions took place in a computer lab on campus. There were 25 computers available for participant training. The lab was set up in a stylized figure eight with meeting tables in the middle and computers against the walls. This allowed the researcher to stand in the middle of the room and see what each participant was doing simply by turning around. The participants chose to work in the larger circle of computers, so no one faced the centre of the computer lab. Each computer was a PC with Internet access through the University network. Each computer had Microsoft Outlook 97 installed the week before the training.

Each computer had the SWIFT program installed on it and also had the Internet address of the PLSystem in the bookmarks of the browser. This allowed the participants in any group to sit at any computer in the lab and do their training. None of the machines had sound enabled, as there was a concern about sound from one machine causing a distraction to learners on a different machine. The option of using headphones with the computers was not suggested until after the training was completed. The machines all had 3.5' Floppy drives and CD-ROM drives. All computers had monitors set at a resolution of 1024 by 768 pixels. For input devices, all machines had a standard two-button mouse and standard keyboard. For the sake of uniformity, the sound was disabled on all machines so that no participants would be distracted by sounds emanating from another computer. This disabling of sound also removed any possibility of background music being played to aid knowledge retention and participant focus, and thus removed the variable involving Olsen's (1997) findings about background music and knowledge retention.

CHAPTER 4

ANALYSIS

Initially in this chapter, the demographic information about the participants is described. Then the performance data from the pre and posttest evaluations are presented. Next, the results of the participant surveys are presented.

Demographics

There were 32 participants who finished the study of the 42 who completed the initial training. The mean age of the participants is 42 years, with a minimum age of 31 years and a maximum age of 59 years. Of the 20 males and 12 females who completed the study, 96.9% had a home computer and 90.6% had an Internet connection in their house. When it came to daily computer usage, the participants had a mean usage of 6.7 hours per day at both home and work. This includes a minimum of one hour each day to a maximum usage of 11 hours a day. The participants reported a great variety in the number of years of experience using a computer. The minimum experience reported was 5 years compared to a maximum of 38 years. The participants' mean number of years using computers was 14.7 years. Tables 4.1, 4.2, and 4.3 provide summary information regarding participant demographics.

Table 4.1: Measures the Central Tendency and Dispersion for participant age, computer usage and years of experience with computers.

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	32	31	59	42.25	7.16
Daily hours of computer usage	32	1	11	6.70	2.44
Years of experience using computers	32	5	38	14.71	6.81

Table 4.2: Frequencies for the question: Does participant have a computer in their home?

Valid	Frequency	Percent	Cumulative Percent
yes	31	96.9	96.9
no	1	3.1	100.0
Total	32	100.0	

Table 4.3: Frequencies for the question: Does participant have an Internet connection in their home?

Valid	Frequency	Percent	Cumulative Percent
yes	29	90.6	90.6
no	3	9.4	100.0
Total	32	100.0	

The data in this study is split into three groups across the four evaluations. The groups are Group A (SWIFT, no request for review), Group B (SWIFT, with request for review), and Group C (PLS, daily review). Table 4.4 presents the means and standard deviations for demographic data including pretest results for all groups prior to the training. Table 4.4 only includes the data from the participants who completed the entire research study. Appendix I presents the means and standard deviations for demographic data by group for all the people who started the study, regardless of whether they withdrew or completed the study.

Table 4.4: Group Frequencies of Pre-training variables for all the participants who finished the study.

	SWIFT A (No Request)		SWIFT B (Request)		PLS C		Total	
Gender	Males	Females	Males	Females	Males	Females	Males	Females
	7	4	7	5	6	3	20	12
Computer at home	Yes	No	Yes	No	Yes	No	Yes	No
Internet Access at home	11	0	12	0	8	1	31	1

Table 4.5: Means and Standard Deviations for Pre-training variables by Group for all the participants who finished the study.

	SWIFT A (N = 11)		SWIFT B (N = 12)		PLS C (N = 9)		Total (N = 32)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	43.8	5.69	40.1	7.41	43.2	8.44	42.25	7.16
Hours per day using computer	6.9	2.41	7.2	2.52	5.9	2.47	6.70	2.45
Number of years using computers	13.6	7.43	13.0	4.09	18.3	8.20	14.72	6.82

The one area of notable difference between the groups was the number of years using computers. The PLS group had a mean score of 18.3 years compared to 13.6 and 13 respectively for the SWIFT groups. This difference of approximately 5 years seems to be large especially given the small number of participants in this study. A Pearson Product Moment Correlation was calculated to determine the relationship between the number of years using computers and pretest performance, which found that there was no significant correlation between these two items.

Performance Data

Table 4.6 presents the means and standard deviations data for all groups by the four testing sessions. These were the pretest before training, posttest 1 which was the training day posttest, posttest 2 which was 30 days after training and posttest 3 which was 60 days after training. The means had a maximum possible score of 100 as each test was scored out of 100. Table 4.6 includes only the data from participants who completed the entire research study. Appendix J presents the means and standard deviations data for all groups by the four testing sessions and includes the data from all participants who started the study. The people who withdrew from the study have their data included with the sections of the study that they took part in.

Table 4.6: Means and Standard Deviations for pretest and posttest data for all participants who completed the study.

		Pretest	Posttest 1	Posttest 2 30 day	Posttest 3 60 day
Group A N = 11 (SWIFT)	Mean	64.27	77.64	74.64	70.09
	Std. Deviation	5.18	6.58	4.76	5.77
Group B N = 12 (SWIFT)	Mean	66.42	79.17	75.58	72.67
	Std. Deviation	6.79	7.59	7.17	8.27
Group C (PLS) N = 9	Mean	68.33	86.11	81.89	79.33
	Std. Deviation	7.21	5.06	4.14	2.83
Total	Mean	66.22	80.59	77.03	73.66
	S.D.	6.41	7.33	6.30	7.16

Examining the variance results as is done in Table 4.6 violates the assumption of homogeneity of variance. However, due to the robust nature of this test, the researcher would like to point out an interesting phenomenon that can be seen from the data. On the pretest, the PLS group actually had more internal variability (Mean – 68.33 & S.D. -

7.21) than the other two groups (Means – 64.27 and 66.41 & S.D. 5.18 and 6.79). Yet, on the subsequent posttests, the variability in the PLS group is much lower. An analysis of the individual group variances, using maximum and minimum individual test scores show that the performance variability of the SWIFT groups (A and B) on the 30 day and 60 day posttests (posttest 2 and posttest 3) were greater than the PLS Group. The results on posttest 2 were as follows: PLS (Mean – 81.89 & S.D. – 4.13); SWIFT Group A (Mean – 74.63 & S.D. – 4.76); SWIFT Group B (Mean – 75.58 & S.D. – 7.16). This variability trend continued in posttest 3, whose results were as follows: PLS (Mean – 7.33 & S.D. – 2.82); SWIFT Group A (Mean – 70.09 & S.D. – 5.77); SWIFT Group B (Mean – 72.67 & S.D. – 8.27). Figures 4.1, 4.2 & 4.3 plots the performances by group, which highlights this phenomenon.

From the individual plots in figures 4.1, 4.2 and 4.3, it would appear that the PLS users have a distinct retention pattern over time that is not evident in SWIFT groups A and B. There does not appear to be a discernable pattern to SWIFT group A or SWIFT group B user performance. All of the participants in the PLS group C have a very similar pattern for their four test scores. They all improve noticeably between the Pre-test and the training day post-test. From there the difference between the highest and lowest scores is 16 marks out of 100. The 30 day post-test sees that gap narrow to 11 marks and the 60 day post-test narrows again to 7 marks. This narrowing of test scores has the participant scores looking very uniform in Figure 4.3 as opposed to the SWIFT groups A and B. There is almost the same variability in test scores on the 60 day post-test as on the training day post-test. SWIFT group A had a 17 mark out of a hundred variability between the highest and lowest scores on the 60 day post-test, which is much larger than the variability the PLS group C had on the same test. SWIFT group B had an even greater difference with a 24 mark difference between the highest and lowest scores on the same test. The appearance of the graphs show an obvious pattern in the PLS group C scores that is not evident in the SWIFT groups A and B scores.

Each line on the graphs in Figures 4.1, 4.2 and 4.3 is a visual representation of one participants' score. Each line shows the individuals' scores across the four tests. Each graph has the individual scores for every participant who completed the study in the group represented.

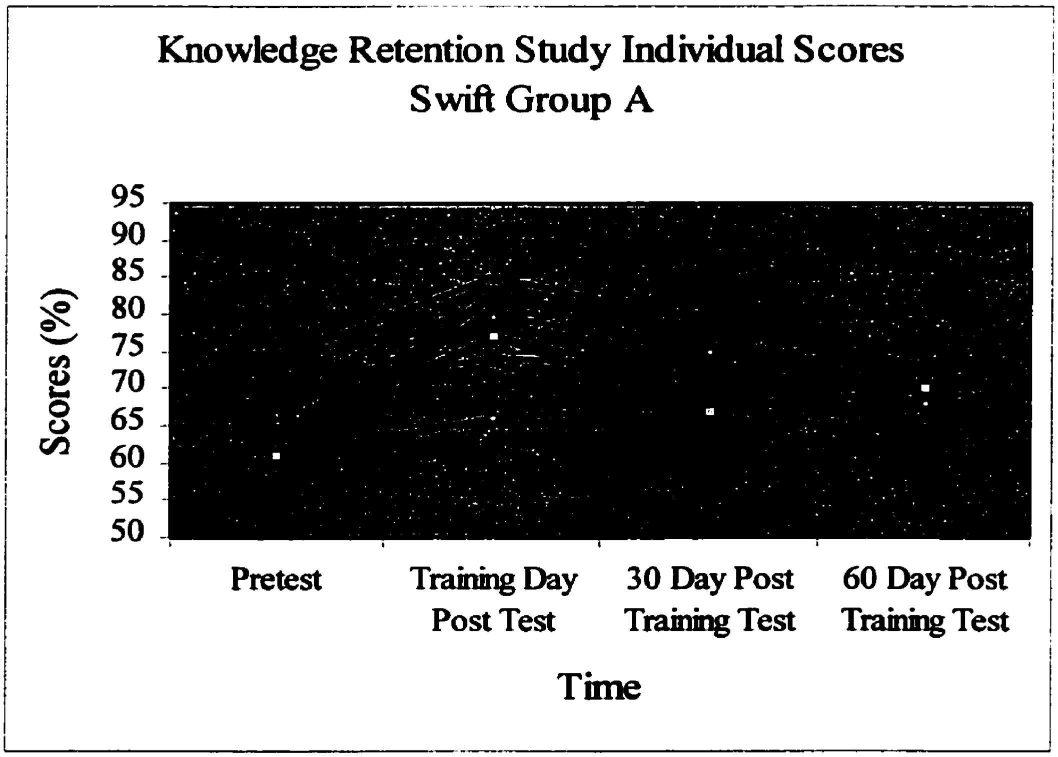


Figure 4.1 – Graphical representation of all participant test scores in SWIFT Group A.

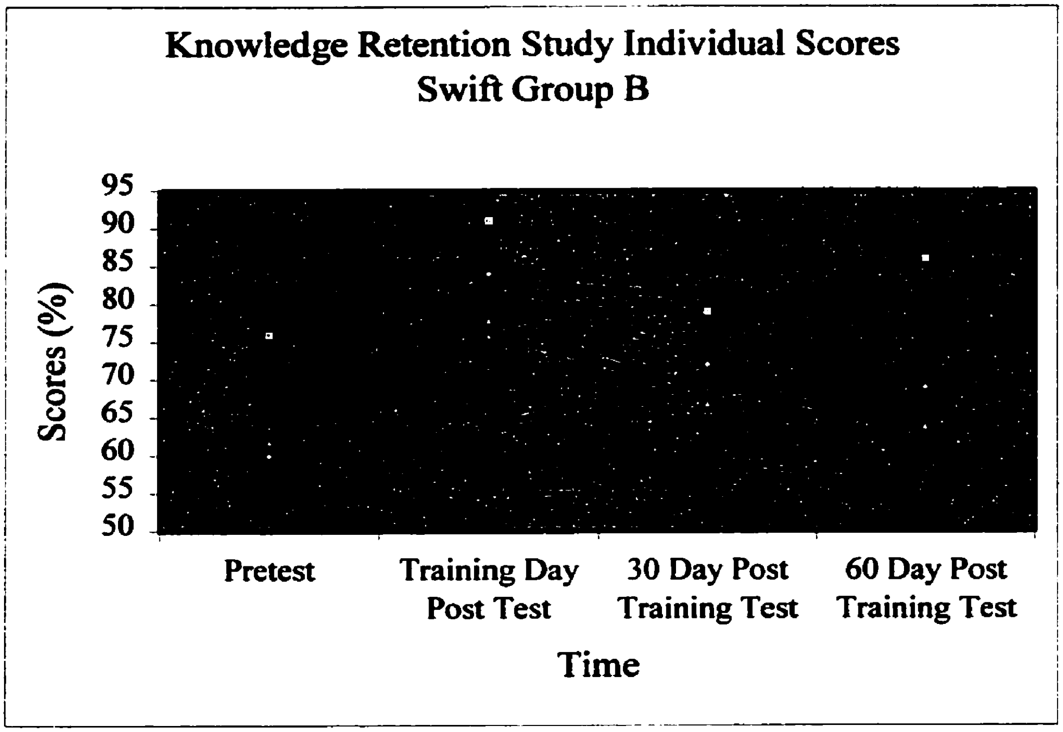


Figure 4.2 – Graphical representation of all participant test scores in SWIFT Group B.

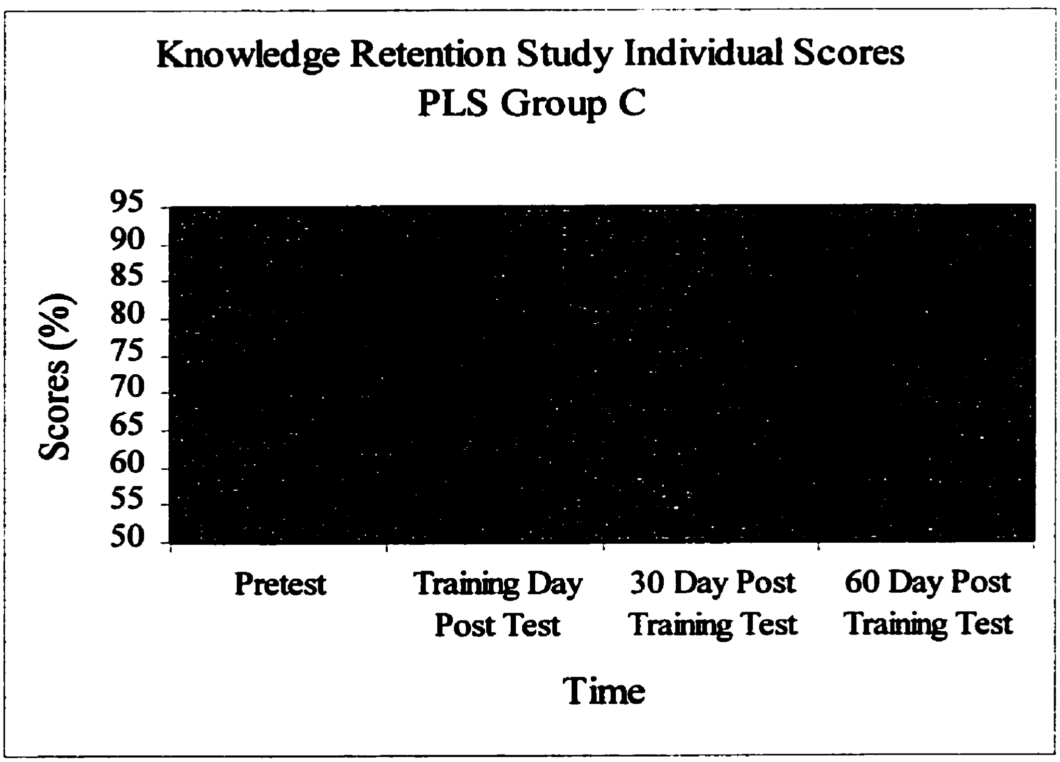


Figure 4.3 – Graphical representation of all participant test scores in PLS Group C.

A commonly used analysis for this type of research design is the repeated measures ANOVA. When a repeated measures ANOVA was performed, there were significant differences between groups. However, the groups improved performance over time, there was no significant group by time interaction. (See Table 4.7).

Table 4.7: Time by Group effects for pre and post-test data for all participants who completed the study.

Effect		Value	F	Hypothesis df	Error df	Sig.
TIME	Wilks' Lambda	.125	62.987	3	27	.000
TIME * GROUP	Wilks' Lambda	.854	.742	6	54	.618

This may be the result of the significantly high variability in the two SWIFT groups. Therefore, an individual analysis was performed for each testing period and the results are shown on Table 4.8. Table 4.8 provides an analysis of the variance for group means for each of the four testing periods (Pretest, Posttest 1, Posttest 2 and Posttest 3). The pretest results suggest that there were no significant differences in content knowledge among the three groups prior to training. There were statistically significant differences between groups after Posttest 1, Posttest 2, and Posttest 3.

Table 4.8 shows a significant effect on tests by time. Figure 4.4 graphically represents the test scores to show the differences in mean test scores over time. There were dramatic differences in participant scores between the pre-training test and post-test #1. There were less dramatic but still significant differences on the mean test scores between post-test 1 & post-test 2, and post-test 2 & post-test 3.

Table 4.8: Individual Analyses of Variance for pre and posttests by group.

		Sum of Squares	df	Mean Square	F	Sig.
Pretest	Between Groups	82.370	2	41.185	1.003	.379
	Within Groups	1191.098	29	41.072		
	Total	1273.469	31			
Posttest 1	Between Groups	394.618	2	197.309	4.502	.020
	Within Groups	1271.101	29	43.831		
	Total	1665.719	31			
Posttest 2	Between Groups	300.618	2	150.309	4.695	.017
	Within Groups	928.351	29	32.012		
	Total	1228.969	31			
Posttest 3	Between Groups	441.643	2	220.821	5.571	.009
	Within Groups	1149.576	29	39.641		
	Total	1591.219	31			

Figure 4.4 provides a graphic representation of the means for the three groups (SWIFT A & B, and PLS) across time. Figure 4.4 distinctly shows the difference in knowledge retention gains between the three groups. The most remarkable difference is the scores of the PLS group on the three posttests compared to the scores of the other two groups on the posttests.

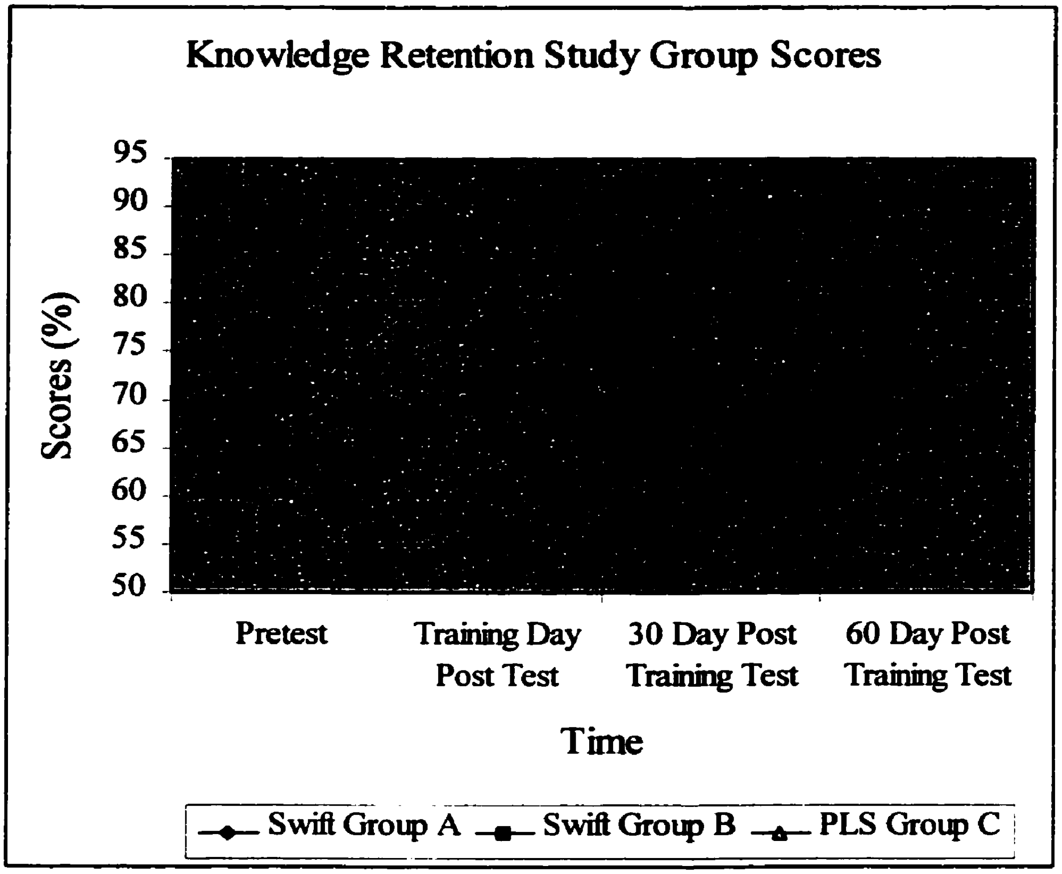


Figure 4.4: Mean performance of the SWIFT (A) and SWIFT (B), and PLS (C) groups across testing periods. This figure represents data from the participants who completed the study.

According to some participants, vacation time interfered with daily practice sessions. Many of the participants went on vacation during the first month of the study and this may account for part of the drop in 30-day posttest performance across groups, although this does not explain why SWIFT group A had a similar drop since they were not asked to review.

The results for all participants including the people who withdrew from the study are presented in Appendix K. Appendix K presents similar trends as Figure 4.4 which include the PLS group C improving much more on the training day posttest than either of the SWIFT groups. The PLS group continued to score higher than the SWIFT groups on the 30 and 60 day posttests. The SWIFT group A constantly scored the lowest on the all content tests, both including and omitting the people who did not finish the study.

All participants who started the training, irrespective of group, completed the initial training, but the Profound Learning group took significantly longer to complete the training than either of the SWIFT groups. This appears to be the result of two factors, 1) the PLSystem incorporates review as part of the training, and 2) the World Wide Web link was sometimes slow in presenting the material. The delay in transmission occurred because the data for users was being generated from an off site server. The PLS group had a mean training time of 4 hours, 20 minutes. This was noticeably longer than either of the SWIFT groups. SWIFT group A had a mean training time of 3 hour, 26 minutes and SWIFT group B's mean training time was 3 hours, 20 minutes. The PLS group took, on average, an extra hour to complete the training over the SWIFT group B. Table 4.9 presents the means and standard deviations for training time with group.

Table 4.9: Means and Standard Deviations for training time with group.

GROUP	Mean (in minutes)	N	Std. Deviation
SWIFT A	206.73	11	24.59
SWIFT B	200.75	12	46.70
PLS C	260.00	9	37.02
Total	219.47	32	44.64

Table 4.10 presents results from a oneway ANOVA of the time taken to complete the training by group, which shows a significant difference in training time with group. This result might have been due to the much greater amount of time the PLS group used to complete the training than the two SWIFT groups (A and B).

Table 4.10: Oneway ANOVA of time taken to complete the training with group.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20775.537	2	10387.768	7.347	.003
Within Groups	41004.432	29	1413.946		
Total	61779.969	31			

There was not a significant difference between the amount of time taken to complete the training session and the score on the training day posttest. It may be argued that training time was an important factor in achievement on the posttests because the PLS group took much longer to complete the training and scored much better on the training day posttest. (see Table 4.11). Inversely, the SWIFT groups took much less time to complete the training and they scored much lower on the posttests. Thus, it might also be argued that the training methodology alone did not affect the achievement on the posttests, but the amount of time taken to complete the training was the important factor in the achievement on the posttests.

Table 4.11: Correlation of time to complete the training with test score on posttest #1.

		Posttest #1
Training Time	Pearson Correlation	-.084
	Sig. (2-tailed)	.648
	N	32

The researcher was unable to determine if the groups A, B and C participants were actually reviewing the material over the sixty-day trial period. It was planned that groups A and B review rates would depend on their self-reports. Initially, it was thought that the group C users would be tracked by their logins to the program, but the functioning and functionality of the tracking software was not clearly explained to all the members of the research team. The tracking software for group C did not provide data which could be quantified in a meaningful way. However, as part of the follow-up questionnaire, participants were asked to report on how often they reviewed. The SWIFT group A were not asked to engage in any retention activities and their self-report indicated that none of the Group A participants actually reviewed the material during the sixty-day period. Both the Profound and SWIFT B groups were asked to review and they reported varying levels of compliance. Table 4.12 presents the reported participant review rates.

Table 4.12: Group percentages and number of participants responding to a question about how often the material was reviewed.

Outlook Study Review Rates by Group				
		Reviewed Often	Reviewed Sometimes	Reviewed Rarely
Group B (SWIFT)		41.67%	33.33%	25%
	n = 12	5	4	3
Group C (PLS)		66.66%	22.22%	11.11%
	n = 9	6	2	1

Survey Data

The survey data were divided into three sections based on the measures used to collect the data. The three measures used were 1) Kay's (1989) Affective Scale which was used as a pre-training measure, 2) Kay's (1993) Computer Attitude Measure (CAM) which was used as a pre-training measure, and 3) Knezek & Miyashita's (1993) Computer Attitude Questionnaire (CAQ) which was used as a post-training measure. The data will be presented in the order which the participants completed the measures. Therefore, Kay's Affective Scale will be presented first, followed by Kay's Computer Attitude Measure and then Knezek & Miyashita's Computer Attitude Questionnaire.

Affective Scale

The first survey measure used was Kay's (1989) Affective Scale (Appendix B, questions # 1-10). The Affective Scale was administered as part of the Pre-training survey before the participants received any training. The questions numbering from 1 to 10 were the Affective Scale portion of the Pre-training survey. The Affective Scale is a ten question instrument used to measure how participants perceive computers. Participants rated their semantic perceptions of computers using 10-paired descriptors that offered a positive and negative scale. Overall, the participants had a positive perception of computers as they responded with an aggregate mean score of 4.3 out of a maximum possible score of 5. Table 4.13 presents the results of the participant responses to this instrument.

Table 4.13: Measures the Central Tendency and Dispersion for Participant responses to the Affective Scale (1 - negative, 5 - positive).

Affective Scale Descriptive Statistics			
Question	N	Mean	SD
Unpleasant / Pleasant	32	4.2500	.5080
Suffocating / Fresh	32	3.8750	.7513
Dull / Exciting	32	4.0000	.7620
Unlikable / Likable	32	4.1563	.7233
Uncomfortable / Comfortable	32	4.0000	.8424
Bad / Good	32	4.3125	.6927
Unhappy / Happy	31	3.8387	.8601
Tense / Calm	32	3.4688	.9153
Empty / Full	32	3.8750	.9419
Artificial / Natural	32	3.0312	1.1496
Summative Total	32	4.3125	.5351

On the survey, the participants answered that they felt computers were pleasant (Mean – 4.25), likable (Mean – 4.16) and good (Mean – 4.31). The participants also responded that they felt quite positively in their opinion that computers were fresh (Mean – 3.87), exciting (Mean – 4.00), comfortable (Mean – 4.00), happy (Mean – 3.84) and full (Mean – 3.87). The participants responded more on the positive end of the scale for nine out of the ten items in this measure.

The responses for the tenth question, "Artificial / Natural" provide food for thought. Participants answered neutrally with a mean score of 3.03. It would be interesting to have an opportunity to get a more elaborative answer to this question. How could computers be anything but artificial, since a definition of artificial is man-made? Computers are definitely not something that can be found in nature. However, it is tough to find an office in the workplace which does not have a computer in it. The participants could have interpreted "natural" as computers are now a natural part of offices and workplaces.

A Pearson correlation was conducted on the participant scores on the Affective Scale and the four content test scores, which showed a significant relationship between the score on Kay's (1989) Affective Scale and the test scores of the participants on the pretest ($r = .88$, $p < .05$). Table 4.14 presents the results of this analysis. This might be the result of people's untrained attitudes as the relationship becomes non-significant after training was completed. The more positive participants might have originally been more skilled or comfortable with the technology and the training might have leveled the playing field for the less skilled or less comfortable participants.

Table 4.14: Correlation between the four content tests and Kay's (1989) Affective Scale.

		Affective Scale
Pre-test	Pearson Correlation	.026
	Sig. (2-tailed)	. 886
	N	32
Posttest 1	Pearson Correlation	.058
	Sig. (2-tailed)	. 752
	N	32
Posttest 2	Pearson Correlation	.131
	Sig. (2-tailed)	. 475
	N	32
Posttest 3	Pearson Correlation	.096
	Sig. (2-tailed)	. 600
	N	32

Computer Attitude Measure

The second measure, Kay's (1993) CAM (Appendix B, questions #14 – 23) explored participant attitudes about computers. CAM was administered as part of the Pre-training survey before the participants received any training. The questions numbering from 14 to 23 were the CAM portion of the Pre-training survey. The CAM ratings measure possible participant behaviour on a Likert scale with the headings: 1- Extremely Likely, 2- Likely, 3- Neutral, 4- Unlikely & 5 - Extremely Unlikely. The participants had a slightly positive attitude about computers prior to training judging from their mean score of 2.5 out of 5. Table 4.15 presents the results of the participant responses to this tool.

Table 4.15: Measurements of the Central Tendency and Dispersion for Participant responses on the Computer Attitude Measure (1 - Extremely Likely, 5 - Extremely Unlikely).

Computer Attitude Measure Descriptive Statistics			
	N	Mean	SD
14. Use a word processor	32	1.5625	.7156
15. Use a computer regularly	32	1.0938	.2961
16. Identify basic computer parts & functions	32	1.9687	1.0621
17. Elaborate on computer applications in society	32	2.8438	1.1103
18. Teach another to use a computer software package	32	2.3750	.9419
19. Learn a new software package	32	1.8438	.7666
20. Discuss + and - of software packages	32	2.7812	1.2111
21. Use computer-aided instruction	32	2.0312	.6468
22. Install software on a computer	32	2.0625	1.2684
23. Do a significant task on a computer	32	1.6562	.8273
Summative Total	32	2.5000	.6720

On the survey, the participants answered several questions in a way which indicated extremely likely behaviour for them would include item 14 use a word processor (Mean – 1.56), item 15 use a computer regularly (Mean – 1.09) and item 23 do a significant task on a computer (Mean – 1.65). The participants' answers describe participants likely behaviour for them would include item 16 to identify basic parts of a computer and their functions (Mean – 1.97), item 18 to teach someone to use a computer software package (Mean – 2.37), item 19 to learn a software package they have never used before (Mean – 1.84), item 21 to use computer-aided instruction (Mean – 2.03) and item 22 to install a software package onto a computer (Mean – 2.06). Interestingly, item 20, "Discuss strengths and weaknesses of various software packages," only had a mean score of 2.78. Most people can tell you what they like and don't like about computer programs they use. The undecided nature of the responses might show some confusion about how to answer the question or point to the ambiguity of the item. Does the question ask about a variety of programs that have a similar function or a variety of programs with different functions? For an example of programs with similar functions, if someone has only used Microsoft Word, they might know the strengths and weaknesses of that program but they would not be able to comment on Corel Wordperfect or Lotus Notes. If the question targeted the strengths and weaknesses of a variety of programs with different functions, that might include a word processor, a spreadsheet, an email program, and the like. The question might have been interpreted with a focus on different words in the question. Maybe the participants do not talk about computer programs that often.

A Pearson product moment correlation was conducted on the participant scores on the CAM and the four content test scores which revealed a significant negative correlation between the CAM and the pretest scores ($r = -.36$, $p < .05$). There was no significant relationship between the score on CAM and the post-test scores of the participants. Table 4.16 presents the results of this analysis.

Table 4.16: Correlation between the four content tests and Kay's (1993) Computer Attitude Measure.

		CAM
Pre-test	Pearson Correlation	-.363
	Sig. (2-tailed)	.041
	N	32
Posttest 1	Pearson Correlation	-.239
	Sig. (2-tailed)	.188
	N	32
Posttest 2	Pearson Correlation	-.225
	Sig. (2-tailed)	.216
	N	32
Posttest 3	Pearson Correlation	-.050
	Sig. (2-tailed)	.785
	N	32

Computer Attitude Questionnaire

The final survey item used was on Knezek & Miyashita's (1993) Computer Attitude Questionnaire (CAQ) (Appendix D, questions # 1-12). CAQ was administered as part of the post-training survey 30 days after the participants received their training and just before the participants completed the post 30 day post-test. The questions numbering from 1 to 12 were the CAQ portion of the post-training survey. The CAQ ratings measure possible participant behaviour on a Likert scale with the headings: Strongly Agree (scored – 1), Agree (scored – 2), Undecided (scored – 3), Disagree (scored – 4) & Strongly Disagree (scored – 5). The participants had a fairly neutral attitude about computers as they responded with a mean score of 2.8 out of a maximum possible score of 5. Table 4.17 and Figure 4.5 present the results of the participant responses to this tool.

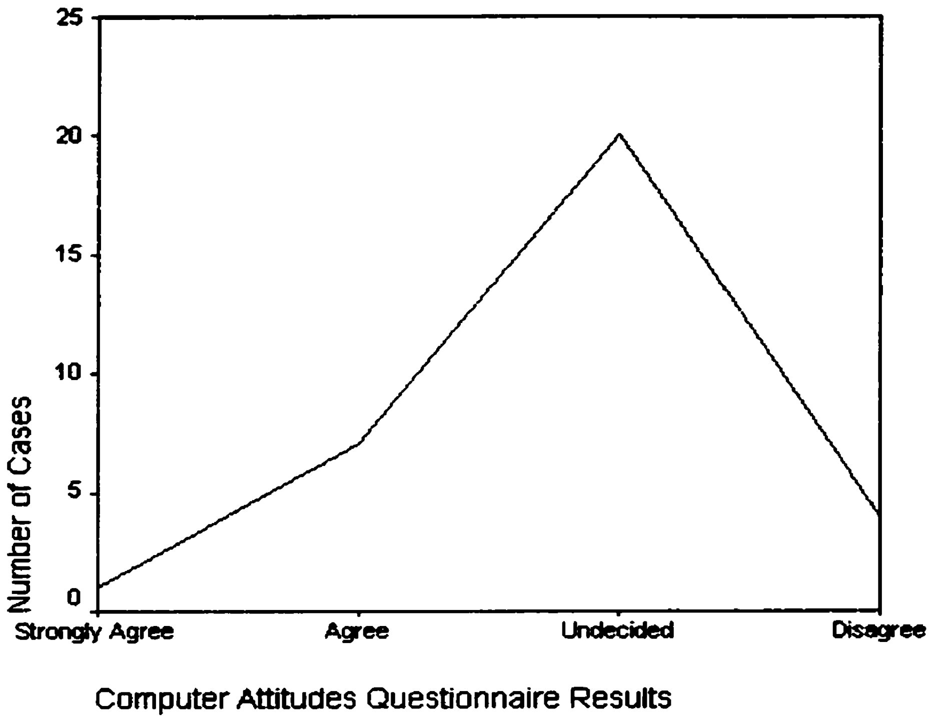


Figure 4.5 - Computer Attitude Questionnaire graph of Central Tendency and Dispersion. (1 - Strongly Agree, 5 - Strongly Disagree).

Table 4.17: Measures the Central Tendency and Dispersion for Participant responses on the Computer Attitude Questionnaire (1 - Strongly Agree, 5 - Strongly Disagree).

Computer Attitude Questionnaire Descriptive Statistics			
	N	Mean	SD
1. Program is "user-friendly"	31	1.9355	.7273
2. Appropriate detail throughout program	30	2.2333	.9353
3. Appropriate feedback for incorrect answers	30	2.6667	.8023
4. Liked the program	31	2.1290	.7634
5. Would recommend the program	31	2.3871	.8823
6. Can access Outlook whenever wanted	32	1.4687	.5671
7. Enough training to use Outlook effectively	32	2.0000	.6720
8. Appropriate feedback for correct answers	30	2.4000	.9322
9. Good computer support	32	1.4688	.5070
10. Program teaches well	31	1.9032	.5388
11. Practical things can be done using computers	32	1.6250	.7071
12. Can learn by myself about computers	32	2.5625	.9136
Summative Total	32	2.8438	.6773

On the Computer Attitude Questionnaire, the participants answered positively to: I can access Outlook whenever I want (Mean – 1.47), I have good computer support at work (Mean – 1.47) and With computers it is possible to do practical things (Mean – 1.62).

It is interesting to note that the most negatively answered question was number three, "I think that appropriate feedback is given for incorrect answers." With a mean score of 2.67, the responses were in the Agree / Undecided range. But compared to the positive nature of the rest of the participant responses, it is possible to believe that the appropriateness of the feedback could be improved upon in some way.

A correlation was conducted on the participant scores on the CAQ and the four content test scores, which showed no significant relationship between the score on Computer Attitude Questionnaire and the test scores of the participants. Table 4.18 presents the results of this analysis.

Table 4.18: Correlation between the four content tests and on Knezek & Miyashita's (1993) Computer Attitude Questionnaire.

		CAQ
Pre-test	Pearson Correlation	.149
	Sig. (2-tailed)	.415
	N	32
Posttest 1	Pearson Correlation	.188
	Sig. (2-tailed)	.302
	N	32
Posttest 2	Pearson Correlation	.236
	Sig. (2-tailed)	.194
	N	32
Posttest 3	Pearson Correlation	.241
	Sig. (2-tailed)	.184
	N	32

There were three questions that were asked on both the Pre-training survey and the Post-training survey. Since these were the only questions asked before and after training, they are the only questions that can be examined to see what changes occurred over time to the attitudes of the participants. The questions were: I have good computer support at work (Pre-training survey #11, Post-training survey #9); With computers it is possible to do practical things (Pre-training survey #12, Post-training survey #11); and I can learn by myself what I need to know about computers (Pre-training survey #13, Post-training survey #12). Table 4.19 presents the aggregate mean scores of the three Pre and Post-training questions. Figure 4.6 graphically presents aggregate mean scores of the three Pre and Post-training questions.

Table 4.19 – Pre and Post-training Participant Mean Responses (1 - Strongly Agree, 5 - Strongly Disagree).

	Pre-training	Post-training
I have good computer support at work	1.37	1.46
With computers it is possible to do practical things	1.65	1.62
I can learn by myself what I need to know about computers	2.59	2.56

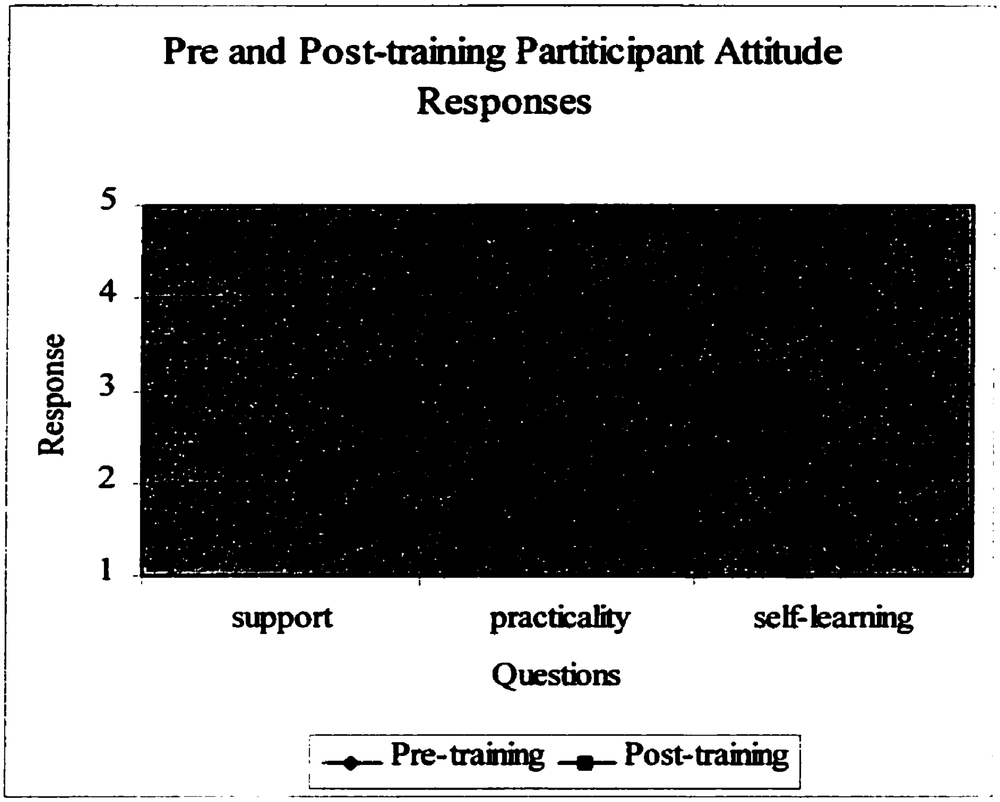


Figure 4.6 - Aggregate Mean Scores of the three Pre and Post-training questions. (1 - Strongly Agree, 5 - Strongly Disagree) This figure represents data from the participants who completed the study.

The interesting question suggested by this data is regarding the effect the study had on participant attitudes. The Pre and Post-training responses are very similar so it might be argued that the first 30 days of the study had very little effect on the attitudes of the participants. It might have been interesting to ask the same questions at the 60 day mark of the study to observe if the responses continued to stay consistent with what was observed in the first 30 days.

CHAPTER 5

DISCUSSION

The goal in this study was to evaluate the impact of training and the effectiveness of different types of knowledge retention activities after using a CBT program to learn about Microsoft Outlook 97. By comparing three different types of the retention activities the participants completed, it was found that user retention of knowledge can be significantly affected. The surveys and performance evaluations are reviewed and discussed. Study limitations and considerations for future research are then given. The section concludes with a summary and conclusions of the study.

Survey Results

Demographics

In the surveys completed by the participants, it was found that the participants all used computers regularly. Generally, the participants had several years experience with computers and they all used computers every day, at home, in their workplace or both. The responses show that on average the participants spend 6.7 hours a day using computers. This experience and computer usage rate might account for the positive opinions that the participants held regarding computers before the training took place.

Affective Scale

The first survey items were from Kay's (1989) Affective Scale. On this measure, the participants reported an aggregate score of 4.31 on a scale with 5 possible responses with a standard deviation of 0.535. These results suggest that the participants have a very positive perception of computers and the role of computers in the world before the training session. Only one participant in the study responded neutrally and no one indicated a negative perception of computers.

The participants were too similar in their responses to make many interesting observations using this data. It would have been interesting to have the participants respond to this attitude measure again at the end of the sixty days of the study to see if the attitudes changed at all. This would have allowed the possibility of further study of participants' attitudes from before and after the study, and determine whether there were any changes in the final 30 days of the study.

There might have been a possible source of error introduced to this measure because of the layout of the measure. For example, all the positive words were on the right and all the negative words were on the left which may have influenced how participants responded. If the positives and negatives were intermixed, that might have affected how participants answered some of the questions in this measure. Also, if the questions were asked in a different order, with the more neutrally answered questions at the beginning of the measure, this might have influenced how the participants answered the remainder of the questions.

The Computer Attitude Measure

The second set of survey items were from Kay's Computer Attitude Measure (1993). This measure explored participant attitudes about computers and possible participant behaviour regarding computers before the training session. The range of behaviour ratings went from Extremely Likely (scored a 1) to Extremely Unlikely (scored a 5). Over ninety percent of the finishing participants chose the slightly positive middle ground of Likely and Neutral. The participants reported a mean score of 2.50 on a scale from 1 to 5 with a standard deviation of 0.672. The participant scores on this measure were quite uniform and lend support for the generalizing of the results regarding this measure.

The similarity of the participant responses did not allow any meaningful comparisons to be made using this data. It would have been interesting to have the participants respond to this measure again at the end of the training sessions. A comparison of pre and post training attitudes may have yielded some interesting changes.

As with the Affective Scale, there may have been error introduced with the order of the demonstration and the completion of the measure. This measure was part of the Pre-training survey, which was presented to Groups A, and B before the presentation of their instructional program and to Group C after the presentation of their instructional program. There might have been an effect on the responses by presenting this measure after the Affective Scale. Presenting the CAM before the Affective Scale might have resulted in different responses.

Computer Attitude Questionnaire

The final survey was made up of thirteen items. The first twelve items came from Knezek & Miyashita's Computer Attitude Questionnaire (1993). The thirteenth item was a question regarding the participants' behaviour in regard to their reviewing the instructional material. Knezek & Miyashita's Computer Attitude Questionnaire explored participant attitudes about computers 30 days after the training session. The reports from this measure were quite neutral with over sixty percent of the participants choosing Neutral (3) from a range of attitude ratings from Strongly Agree (1) to Strongly Disagree (5). The mean participant score was 2.84 with a standard deviation of 0.677. The Computer Attitude Questionnaire did not enable the researcher to make comparisons between the three groups.

Further exploration into the responses received on the CAQ could be warranted in a future study. The responses from the CAQ were the least positive results of any of the three survey instruments. It would be interesting to find out why the participants became less positive as the study progressed. It begs the question, "Was this a trend which could have been analyzed if the participants' attitudes were measured at the end of the study?" If it was a trend, one could have explored whether the instructional programs, the retention activities, the research study or something else may be related to the decline.

Performance Evaluation

The original hypothesis stated that there would be no significant difference in knowledge retention between students using PLS (Group C), students using SWIFT with no review activities (Group A) and students using SWIFT with user generated review activities (Group B) to learn Microsoft Outlook 97.

An analysis of variance revealed that there was significant differences between students using PLS and both groups of students using SWIFT. On the 30 and 60 day posttests, the students using PLS scored significantly higher on a content test than students using SWIFT.

There are several possible explanations for the PLS group's strong performance relative to the two SWIFT groups. The scores on the pretest show the PLSystem group scoring higher before any training was done. Therefore it might be argued that this group was made up of participants who started the training with some sort of advantage over the other groups. Also, the drop out rate of the PLS group was higher than the SWIFT groups. The PLS group did have to continue with daily log-ins and retention activities, while the SWIFT groups had much less of a time commitment imposed on them by the study, which may have lead to a higher PLS group dropout rate.

Another factor that might have influenced the results of the study involves the instructional programs. The SWIFT groups were not able to use the entire SWIFT program because a portion of the program was disabled for this study. SWIFT has built-in unit tests that users are usually required to complete to help them evaluate their learning. It was thought these unit tests would give the SWIFT users an unfair advantage because the PLSystem did not have the same unit tests. It might be argued that this reduction in functionality could have been a factor in the test results of the SWIFT users. The SWIFT (A) group had no review activities to do and only had to show up at the evaluation session once a month. This is far less than even the SWIFT (B) group who was asked to independently review the CD-ROM on a regular basis. The SWIFT groups were not being monitored and evaluated on a daily basis, the way the PLS (C) group was. Logging in and receiving a score everyday from the program might have lead to improved test scores and improved motivation levels, but it also might have lead to increased stress levels and anxiety. Further studies might plan to have brief exit interviews to determine the reason for the participants' decision to leave the study and also develop a measure of workload and perception of instructional program effectiveness.

The feedback received from each program might have affected the evaluation performances of each group. Clariana et al. (1991) found that it is very important for learners get feedback of some kind and PLS provided feedback in a very structured way. SWIFT group A did not do any retention activities so they did not get anything but minimal feedback on their activities. SWIFT group B did their own learner created retention activities, so there was not a definite structure of feedback due to the individualized nature of the retention activities. It would be interesting to examine the review activities the SWIFT group B participants partook and compare them with groups A and C's activities.

Limitations

The following are issues, which might have affected the results obtained from this investigation. There were a number of limitations regarding the participants involved with the study, not the least of which was the small number who took part in the study. Initially, sixty-eight people signed up to take part, and forty-three actually completed the training. From there, only thirty-two completed the follow-up activities and the post testing. With the thirty-two finishers, the three instructional groups were not split evenly, with SWIFT Group A having 11 finishers, SWIFT Group B having 12 finishers and PLS Group C having 9 finishers. This shows there were not even ten participants in every group. With this small number of participants, it is difficult to defend the statistical results of this study. The participants were also quite homogeneous in regards to their demographic data and their attitudes about computers. This homogeneity might have been due to the fact that the participants came from a convenience sample rather than the general population. This limited the amount of analysis that could be done and conclusions that could be drawn about the participants.

The limits placed on the functionality of the instructional programs may have affected the results of this study. The removal of the email and calendar functions of Microsoft Outlook 97 may have affected how the participants responded to the training sessions.

This might explain why participant attitude scores were so neutral after the training session.

There was a lack of possible learner feedback with the way SWIFT was used in this study. This lack of feedback reduced the opportunity for "significant benefits" to the user for even a minimal amount of feedback over no feedback at all (Clariana et al, 1991). The disabled module pretests, exercises, quizzes, module posttests, and course posttest limited the amount of possible feedback the user could receive during training. Even though Clariana et al. (1991) found that it is very important for learners get feedback of some kind during their instructional session, there was no structured feedback mechanism in place for the retention portion of the study as SWIFT was not designed to be reviewed over time, especially without it's disabled sections. The "significant benefits" might have affected the performance scores of the SWIFT users on the content tests and thus lead to a conservative view about the results of this study.

Microsoft Outlook 97 is not a program that is normally on the computers in the campus lab used for the initial training sessions in this study. This program was newly installed on the computers in the lab, and the default settings created uniformity for the look of the program. The training programs are based on the default setting of Microsoft Outlook so that uniformity was vital to the training sessions. The value of consistency became evident later as people did the retention activities at their workplace. Microsoft Outlook was installed on the company's network, but it was set up specifically for the company. The appearance of sections of Microsoft Outlook on the workplace computers was quite different from the default settings. This led to some confusion on the part of participants. Several participants chose to do all their retention activities at home where their Microsoft Outlook was set up using the default settings and thus appeared to look exactly like the training programs they had seen. The issue of the appearance of Microsoft Outlook might have had an impact on the findings of the study. The location where people chose to work using Microsoft Outlook, do their retention activities or both could affect the test scores and the results from the post 30 day survey. There might have been an advantage for people who interacted with Microsoft Outlook at home because the test questions and training were based on its default appearance. This potential advantage was not measured and there is no way of knowing if there was any advantage to participants based on where they chose to do their retention activities. Russo, Ward, Geurts, & Scheres (1999) found that changing the environmental context between study and test affected recognition memory. Therefore, having only the training day posttest take place in the training environment might have affected the participant achievement on the training day posttest and the final two posttests in different ways. Participants did not necessarily complete the final two posttests in the same environment in which they did their retention activities, and this might have affected their post-test scores.

There were a number of possibly limiting issues involved with an Internet-based instructional program such as PLS. Irregularities with Internet connections can have a negative effect on the attitudes of participants. Response times during training and retention sessions can lead to frustration when the Internet connection is slow. The PLSystem server is a vital piece of the presentation platform of the instructional program.

The server needs to be monitored closely in case of any electronic or human login difficulties. The last limitation about the presentation platform is in regards to the PLSystem URL address (http://portal.modusoperandi.com/pls). A short and/or easy to remember URL such as www.profoundlearning.com or www.pls.ca may have made it easier for the participants to login anytime, especially if they are away from the computer they usually use for their retention activities. There were a number of participants who found it difficult to log into the PLSystem because of the URL address. Some participants unsuccessfully attempted to use search engines to find the login site. Other participants assumed there had to be a www in the address. The difficulties some participants encountered while attempting to login might have influenced the amount of review that was done by the participants in the PLSystem group. It might have also been a factor in the higher drop out rate the PLSystem group experienced compared to the two SWIFT groups.

Another possible factor in the higher PLS drop out rate could be the review expectations placed on the PLS users. Sinclair, Healy & Bourne (1997), and Sprenger (1999) argued that daily repetition of important information is an important key to building long-term memory. In this study, participants volunteered at their workplace and might have seen participation in the study as work related, as they were trained on a computer program for work, were tested at work and were contacted about the study at work. For the participants, work happens for five days a week and the PLSystem was set to run on a daily (seven days a week) basis. Having to complete three days of review activities on the first day of the week might have been an unattractive option for them. A more extreme example is the participants who went on vacation during the study and were faced with two or three weeks worth of review activities on the day they returned to work. Five minutes of review each day quickly adds up to seventy or eighty minutes of review after a two week vacation.

There were navigation issues with the PLSystem, including the use of colour coding and shading, that might have impacted the participants success. If colour coding is needed in the program, programmers should use colours that the most possible people can see. According to Chen (1971), 2.6 percent of the Caucasian population in Canada has red-green colour deficiency. Yet this red-green colour scheme is used in the navigation of PLS. The researcher had a difficult time figuring out part of the navigation system because of the use of certain colours schemes, therefore it is possible that some participants encountered similar difficulties. Also, if a navigation button cannot be used in a certain section of the program, there should be visual cue to show that it is inoperable. Often, buttons were grayed out as a visual cue but this was not the case every time and that was a concern to some participants. This showed a lack of internal consistency, which needs to be dealt with in future versions of this product.

The PLSystem may be a good tool for aiding in self-regulated learning. Thiede & Dunlosky (1999) set forth a model of self-regulated learning that has three components: planning, discrepancy reduction and working memory constraints. Participants regulate their learning by setting a desired goal for learning an item. Participants then monitor how well they feel their learning is going and adjust their behaviour with the ultimate goal of learning the material in mind. PLS aids all three components of this model. Daily repetition of important information is another strategy for building long-term memory (Carrier & Paschler, 1992; Leiberman and Linn, 1991; Sinclair, Healy & Bourne, 1997; Sprenger, 1999; Zimmerman, 1990). The PLSystem focused on this idea with the daily review activities built-in to the program, which planned for five minutes of review for each participant each day.

There might be further retention gains if there was more learner control of the program. According to Clariana, Ross & Morrison (1991), Diaz et al. (1998), Lee & Lee (1991), Shin, Schallert & Saverge (1994), and Stanton & Stammers (1990), learner control is vital to the creation of knowledge. There were several parts of the PLSystem which possibly hindered the creation on knowledge, which might have influenced participant performance on the content tests. For example, during the retention activities, the lack of user control of the display of the answers could be alleviated by having the answers appear when the user decides to see them. A clickable answer button or OnMouseOver command would allow users the control to test their memory before the answer appears. There might also be further retention gains if audio cues were included in the instruction and retention portions of the program.

Considerations for Future Study

The PLSystem appears to be a useful training tool, and its use should be studied more in the future. Further studies involving PLS should be conducted with a larger number of participants drawn randomly from a broader population. Further studies might profit from adding more groups to the study. The groups could be a traditionally instructed (ie. human trainer and classroom) group which does no retention activities, a traditionally instructed group which does self-generated retention activities and a PLS group which does no retention activities. The new PLS group would help explore the effect that the PLS training had on the participants learning without retention activities. Also, further studies should be conducted at a different time of year. This study involved over 60 days during the summer and the retention system was optimally designed for daily learner participation. Vacation schedules of the participants limited the optimal effects of the retention system. The next study might also benefit from being longer then 60 days. The evaluation results were following an interesting pattern and it could be of interest to see if this retention pattern continued over a longer period of time.

Any future studies involving the PLSystem would benefit from the use of testing material that has been used before and is much shorter then the 100 item test material that was used in this study. The length of the post 30 day and post 60 day evaluations was given as a reason for participant withdrawal from this study when the researcher corresponded with the participants. It would also allow any awkwardly worded questions to be replaced or corrected. The questions should also be open enough to have more then one correct answer if people have another way to achieve the same objective. Another testing concern was from participants who mainly use the pull-down menus or hot keys when they use Outlook 97. During the collection of the testing materials, there were informal discussions between the participants and the researcher. Several participants commented on the iconic focus of the tests and asked why the testing material did not allow alternate answers for procedural questions which have numerous ways to complete a procedure. The online version of the content test should be formatted so that the submitted data can be transferred directly into a statistics program like SPSS so that the researcher does not have to hand score the online test.

The PLSystem focuses on knowledge (data) retention in its training and retention activities. Daily repetition of important information is an important key to building long-term memory (Sinclair, Healy & Bourne, 1997; Sprenger, 1999). An expansion to a conceptual level of information could be the next step in the exploration of this topic. The PLSystem currently uses maintenance rehearsal as a repetitive kind of information recycling. When information is presented at a conceptual level, the program will be able to utilize elaborative rehearsal as a more complex kind of rehearsal that uses the meaning of the information to help store and remember it (Ashcroft, 1989). A conceptual level of information would allow users more opportunity to transfer knowledge to related items (Healy et al, 1993).

The format of the training session should be changed in any future study. All day training sessions were too long for some participants. The PLSystem is designed for shorter instructional sessions, so it should be advantageous to study the system as it would actually be used. The training sessions should be conducted in a comfortable environment. The computer lab should have comfortable chairs, as this was the largest complaint about the training sessions. The training lab should have computers with earphones so that participants could bring CD's of their favourite music to the training session if they chose to. This would allow participants to use earphones to listen to music and, according to Olsen (1997), would provide an information retention aid for the participants, along with helping participants to focus longer and allowing the brain to process the instructional material through more than one memory path. In a future study in which the participants brought music with them to the training sessions, they should also be asked to listen to the same music when they reviewed the instructional material and when they completed the content tests.

During the training, PLS participants always received an introduction to the program before they completed the pretest and the computer attitude survey. Groups A & B always received an introduction to their instructional program after they had completed the pretest and the computer attitude survey. This might have lead to the difference in the higher responses PLS scored in the computer attitude survey. Also, there was no attempt made to make the introductions to the instructional programs equivalent. There might have been more energy and enthusiasm in one introduction than the other. If this study were to be repeated, this procedure should be changed so that all groups receive the introduction either before or after the pretest and survey, thereby limiting the possible Hawthorne Effect. If this is not possible, a counterbalance should be included to have the introduction order vary from day to day with the introduction presented by an outwardly unbiased person, instead of the vice-president of one of the software companies.

For the compilation of data regarding which users actually reviewed the instructional material on PLS, there should be a tracking system in place that does not rely on the IP addresses of the computers that people log in on. There was a loss of possible data due to the inability to track PLS logins. Therefore, the expected tracking data was limited to three snapshots of user login dates which did not provide much useful data. The research team expected to receive a list of all the days and times when the PLS users logged in to review the instructional material. This communication only happened three times and the reports consisted of the last date and time each participant logged in. This loss of tracking data was the reason why the study had to rely on the self-reports of the participants to determine the frequency of retention review activities performed by participants using PLS. This loss of possible data also provides an example of how important good communication is needed between the research team and the technical people running the hardware the program is installed upon.

Any future studies should use the SWIFT program without disabling any portions of the evaluation and feedback process. The disabled module pretests, exercises, quizzes, module posttests, and course posttest limited the amount of possible feedback the user could receive during training, so they should be left working. This might allow for more user control and feedback as learners move through the program, especially as Clariana et al. (1991) argued that even minimal feedback is preferable over no feedback at all during their instructional session.

There should be more study done on the attitudes of adult learners regarding computer-based training. Any future studies should use attitudinal measures, which better differentiate learner attitudes than the measures used in this study. A measure should be developed which focuses on the adults in the workplace and allows for some difference in the attitudes and opinions in a closely homogenous demographic group. This suggested measure should concentrate on business professionals, as opposed to teaching and academic professionals.

Any future studies involving computer programs that have an adaptable user interface should be aware of the appearance of the program and the impact it might have on the results of the study. Microsoft Outlook 97 was presented in the training sessions in its default appearance. There were situations in which the appearance of adapted interfaces caused confusion with the participants. A continuation from this study might be wise to ask participants where they did their retention activities. People who used Outlook 97 at their home would have the default appearance which was what the instructional software was based on. The workplace version of Outlook 97 looked different than the default. This might have affected the results of the participants on the final two posttests.

Summary and Conclusions

The main purpose of this study was to evaluate the effectiveness of various knowledge retention activities while learning about Microsoft Outlook 97. There were significant differences found in the test scores of the participants in the different training groups. Since the PLS users achieved significantly higher on content tests, it can be argued that the structure of the instruction and retention activities in PLS was the cause of the differences.

Limitations in the study design and training scenarios suggest that this finding be interpreted conservatively, and with an understanding that more research with the PLS and SWIFT training methodologies is needed to confirm or disconfirm these results.

REFERENCES

(1989). *Funk & Wagnalls Canadian College Dictionary*. Toronto: Fitzhenry & Whiteside Limited.

ACNielsen. (2000). *ACNielsen Study Indicates Canadian PC Ownership Now Over 60 Percent*, [Webpage]. ACNielsen. Available: http://acnielsen.com/news/american/ca/2000/20000127.htm [2001, January 17].

Anderson, J., Fincham, J. & Douglass, S. (1999). Practice and retention: A unifying analysis. *Journal of Experimental Psychology, 25*(5), 1120-1136.

Ashcroft, M. (1989). *Human Memory and Cognition*. Boston: Scott, Foresman and Company.

Askov, E., & Bixler, B. (1996). You just received a windfall for technology! So how do you select the best CAI software. *Adult learning, 8*(2), 23-28.

Ayersman, A., Ackermann, E., & Zisman, P. (1996). *Creating a Computer Competency REquirement of Mary Washington College Students.* Paper presented at the Association of Small Computer Users in Education, North Myrtle Beach, South Carolina.

Baeckman, L., & Maentylae, T. (1988). Effectiveness of self-generated cues in younger and older adults: The role of retention interval. *International Journal of Aging & Human Development, 26*(4), 241-248.

Barnett, J. (1984). Facilitating retention through instruction about text structure. *Journal of Reading Behavior, 16*(1), 1-13.

Benbunan-Fich, R. (1999). Assessing learning effectiveness of asynchronous computer-mediated communication in the classroom. *The Journal of Computer Information Systems, 39*(4), 82.

Bloom, B., et al. (1956). *Taxonomy of Educational Objectives. Handbook I: Cognitive Domain.* New York: McKay.

Burns, D., Curti, E., & Lavin, J. (1993). The effects of generation on item and order retention in immediate and delayed recall. *Memory & Cognition, 21*(6), 846-852.

Caple, C. (1996). *The Effects of Spaced Practice and Spaced Review on Recall and Retention Using Computer Assisted Instruction.* Unpublished doctoral dissertation, North Carolina State University, Raleigh, NC.

Carrier, M., & Pashler, H. (1992). The influence of retrieval on retention. *Memory & Cognition, 20*(6), 633-642.

Chen, Y. (1971). Visual discrimination of color normals and color deficients. *AV Communication Review, 19*(4), 417-431.

Chiero, R. (1997). Teachers' perspectives on factors that affect computer use. *Journal of Research on Computing in Education, 30*(2), 133-145.

Clariana, R., Ross, S., & Morrison, G. (1991). The effects of different feedback strategies using computer-administered multiple-choice questions as instruction. *Educational Technology, Research and Development, 39*(2), 5-17.

Clariana, R. (1997). Pace in mastery-based computer-assisted learning. *British Journal of Educational Technology, 28*(2), 135-137.

Compton, B., & Logan, G. (1991). The transition from algorithm to retrieval in memory-based theories of automaticity. *Memory & Cognition, 19*(2), 151-158.

Cotton, R., & McDowell, L. (1990). Students' experiences of course assessment. *Journal of Research on Computing in Education, 23*, 183-187.

Craik, F., & Lockhart, R. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671-684.

Crook, W., & Brady, M. (1998). Computer-assisted instruction in the classroom: Using a web shell. *Computers in Human Services, 15*(2-3), 193-208.

Cunningham, D. J., & McCown, R. R. (1984). The retroactive effects of prior knowledge and elaborative processing on prose retention. *Journal of Experimental Education, 53*(2), 77-85.

D'Souza, P. (1991). The use of electronic mail as an instructional aid: An exploratory study. *Journal of Computer-Based Instruction, 18*(3), 106-110.

D'Souza, P. (1992). E-mail's role in the learning process: A case study. *Journal of Research on Computers in Education, 25*(1), 256-264.

Davey, B., & McBride, S. (1986). Effects of question-generation training on reading comprehension. *Journal of Educational Psychology, 78*(4), 256-262.

Desmarais, L., Duquette, L., Renie, D., & Laurier, M. (1998). Evaluating learning and interactions in a multimedia environment. *Computers in the Humanities, 31*, 327-349.

Diaz, P., Aedo, I., Torra, N., Miranda, P., & Martin, M. (1998). Meeting the needs of teachers and students within the CESAR training system. *British Journal of Educational Technology, 29*(1), 35-45.

Ellison, J. (1999). *Internet use by households* (1), [Webpage]. Statistics Canada. Available: http://www.statcan.ca/Daily/English/990715/d990715a.htm [2000, November 7].

Farr, M. J. (1987). *The Long -Term Retention of Knowledge and Skills*. New York: Springer-Verlag.

Fletcher-Flinn, C., & Gravatt, B. (1999). The efficacy of computer assisted instruction (CAI): A meta-analysis. *Journal of Educational Computing Research, 12*(3), 219-242.

Gardiner, J., & Java, R. (1991). Forgetting in recognition memory with and without recollective experience. *Memory & Cognition, 19*(6), 617-623.

Gemini Learning Systems. (2000). *Gemini: Your eLearning Partner*, [Webpage]. Gemini Learning Systems. Available: http://www.gemini.com/gemini/gemini_main.html [2000, October 10].

Glenberg, A. M. (1984). A retrieval account of the long-term modality effect. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 10*(1), 16-31.

Gobet, F., & Simon, H. (1996). Recall of rapidly presented random chess positions is a function of skill. *Psychonomic Bulletin & Review, 3*(2), 159-163.

Gottfredson, G. (1996). The Hawthorne misunderstanding. *Journal of Research in Crime and Deliquency, 33*(1), 28-48.

Haller, E., Child, D., & Walberg, H. (1988). Can comphrension be taught? *Educational Researcher, 17*(9), 5-8.

Harrison, D., & Pavlik, W. (1985). Age differences in retention of fixed-interval responding: Memory or habitation effects? *Behavioral & Neural Biology, 44*(3), 339-346.

Harrison, A., & Rainer Jr, R. (1992). An Examination of the factor structures and concurrent validities for the computer attitude scale, the computer anxiety rating scale, and the computer self-efficacy scale. *Educational and Psychological Measurement, 52*(3), 746-746.

Healy, A., Clawson, D., McNamara, D., Marmie, W., Schneider, V., Rickard, T., Crutcher, R., King, C., Ericsson, K., & Bourne, L. (1993). The long term retention of knowledge and skills. *The Psychology of Learning and Motivation, 30*, 135-164.

Howe, M. (1972). *Understanding School Learning*. New York, NY: Harper & Row.

Jackson, W. (1988). *Research Methods*. Scarborough, Ont: Prentice-Hall.

Jones, S. (1992). Was there a Hawthorne effect? *American Journal of Sociology, 98*, 451-468.

Kakrajsek, T., Waters, L., Popovich, P., Craft, S., & Hampton, W. (1990). Convergent Validity of Scales measuring Computer-related Attitudes. *Educational and Psychological Measurement, 50*, 343-349.

Kaufman, J., Tesolowski, D., & Roth, G. (1989). Developing a system to facilate the instructor's role in implementing computer based instruction. *Journal of Research on Computing in Education, 22*(2), 464-472.

Kay, R. (1989). A practical and theoretical approach to accessing computer attitudes: The computer attitude measure(CAM). *Journal of Research on Computing in Education, 22*(2), 457-463.

Kay, R. (1993). A practical research tool for accessing ability to use computers: The computer ability survey (CAS). *Journal of Research on Computing in Education, 26*(1), 17-27.

Khalili, A., & Shashaani, L. (1994). The effectiveness of computer applications: A meta-analysis. *Journal of Research on Computing in Education, 27*(1), 48-61.

Kiewra, K., Mayer, R., Christsen, M., Kim, S. & Risch, N. (1991). Effects of repetition on recall and note-taking: Strategies for learning from lectures. *Journal of Educational Psychology, 83*(1), 120-123.

King, A. (1992). Comparison of self-questioning, summarizing, and notetaking-review as strategies for learning from lectures. *American Educational Research Journal, 29*(2), 303-323.

Kinzie, M., Sullivan, H., & Berdel, R. (1992). Motivational and achievement effects of learner control over content review within CAI. *Educational Computing Research, 8*(1), 101-114.

Knezek, G., & Christensen, R. (1997). *Changes in Teacher Attitudes During Six-Week Technology Training Sessions*. Beaumont, Texas: Texas Center for Educational Technology.

Kulik, J., & Kulik, C. (1988). Timing of feedback and verbal learning. *Review of Educational Research, 58*(1), 79-97.

Lansford, C. (1999). *Using Pre-test/Posttest Data to Evaluate the Effectiveness of Computer Aided Instruction.* Paper presented at the SITE 99: Society for Information Technology & Teacher International Conference, San Antonio, Texas.

Lee, S., & Lee, Y. (1991). Effects of learner-control versus program-control strategies on computer-aided learning of chemistry problems: For acquisition or review? *Journal of Educational Psychology, 83*(4), 491-498.

Leh, A. (1998). *Design of a Computer Literacy Course in Teacher Education.* Paper presented at the SITE 98: Society for Information Technology & Teacher International Conference, Washington, DC.

Lehman, E., Mikesell, J., & Doherty, S. (1985). Long-term retention of information about presentation modality by children and adults. *Memory & Cognition, 13*(1), 21-28.

Lieberman, D., & Linn, M. (1991). Learning to learn revisited: Computers and the development of self-directed learning skills. *Journal of Research on Computing in Education, 23*(3), 373-395.

Marcoulides, G., Mayes, B., & Wiseman, R. (1995). Measuring computer anxiety in the work environment. *Educational and Psychological Measurement, 55*(5), 804-811.

Mayer, R. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychologist, 32*(1), 1-19.

McInerney, V., Marsh, W., & McInerney, D. (1999). Validity studies - The designing of the computer anxiety and learning measure (CALM). *Educational and Psychological Measurement, 59*(3), 451-471.

Meyonohk. (1983). *Utilization of a Microcomputer in an Elementary School Learning REsource Centre* . Edmonton: Alberta Education.

Microsoft. (2000). *Product Home Page for Microsoft Outlook*, [Webpage]. Microsoft Corporation. Available: http://www.microsoft.com/office/archive/olk97brch/default.htm [2000, October 5].

Miller, M., & Rainer Jr, R. (1995). Assessing and improving the dimensionality of the computer anxiety rating scale. *Educational and Psychological Measurement, 55*(4), 652-658.

Murdock, B., & Kahana, M. (1993). Analysis of the list-strength effect. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 19*(3), 689-697.

Murray, W. (1998). *Lesson Control and Prior Notification of Lesson Control Type in a Computer-Aided Lesson.* ,University of Calgary, Calgary.

Okolo, C., & Ferretti, R. (1996). Knowledge acquisition and technology-supported projects in the social studies or students with learning disabilities. *Journal of Special Education Technology, 13*(2), 91-103.

Olsen, G. (1997). The impact of interstimulus interval and background silence on recall. *Journal of Consumer Research, 23*(4), 295-303.

Owston, R. (1997). The world wide web: A technology to enhance teaching and learning? *Educational Researcher, 26*(2), 27-33.

Patterson, D., Pullen, L., Evers, E., Champlin, D., & Ralson, R. (1997). An experimental evaluation of HyperCDTX: Multimedia substance abuse treatment education software. *Computers in Human Services, 14*(1), 21-38.

Persico, D. (1997). Methodological constants in courseware design. *British Journal of Educational Technology, 28*(2), 111-123.

Profound Learning Systems. (2000). *The PLSYSTEM,* [Webpage]. Profound Learning Systems. Available: http://www.nvo.com/diskover/custom_html2/ [2000, October 10].

Ranzijn, F. (1992). The sequence of conceptual information in instruction and its effect on retention. *Instructional Science, 20*(5-6), 405-418.

Rogers, E. (1995). *Diffusion of Innovation.* Toronto, Ontario: The Free Press.

Rose, R. (1992). Degree of learning, interpolated tests, and rate of forgetting. *Memory & Cognition, 20*(6), 633-642.

Ross, J. (2000). *An Exploratory Analysis of Post-Secondary Student Achievement Comparing a Web-based and a Convential Course learning Environment.* Unpublished doctoral dissertation, University of Calgary, Calgary.

Rundus, D. (1977). Maintenance rehearsal and single-level processing. *Journal of Verbal Learning & Verbal Behavior, 16*(6), 665-681.

Russo, R., Ward, G., Geurts, H. & Scheres, A. (1999). When unfamiliarity matters: Changing environmental context between study and test affects recognition memory for unfamiliar stimuli. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25*(2), 488-499.

Salaberry, M. (2000). Pedagogical design of computer mediated communication tasks: Learning objectives and technological capabilities. *The Modern Language Journal, 84*(1), 28-37.

Schultetus, R., & Charness, N. (1999). Recall or evaluation of chess positions revisited: The relationship between memory and evaluation in chess skill. *American Journal of Psychology, 112*(4), 555-569.

Selwyn, N. (1997). The continuing weaknesses of educational computing research. *British Journal of Educational Technology, 28*(4), 305-307.

Shin, E., Schallert, D. & Savenye, W. (1994). Effects of learner control, advisement, and prior knowledge on young students' learning in a hypertext environment. *Educational Technology, Research & Development, 42*(1), 33-46.

Sinclair, G., Healy, A., & Bourne, L. (1997). The Acquisition and long-term retention of temporal, spatial and item information. *Journal of Memory and Language, 36*, 530-549.

Singer, H. (1978). Active comphrension: From answering to asking questions. *The reading teacher, May*, 901-908.

Smith, F. (1998). *The Book of Learning and Forgetting*. New York: Teachers College Press.

Spiegel, G., & Barufaldi, J. (1994). The effects of a combination of text structure awareness and graphic postorganizers on recall and retention of science knowledge. *Journal of Research in Science Teaching, 31*(9), 913-932.

Sprenger, M. (1999). *Learning and Memory: The Brain in Action.* Alexandria, Virginia: Association for Supervision and Curriculum Development.

Stanton, N., & Stammers, R. (1990). Self-assessment in computer-based training. *Journal of Research on Computing in Education, 23*, 231-235.

Stewart, R. (1989). Interaction effects of teacher enthusiasm and student notetaking on recall and recognition of lecture content. *Communication Research Reports, 6*(2), 84-89.

Streatmans, G., & Eggen, T. (1989). Computerized adaptive testing: What it is and how it works. *Educational Technology, 38*, 45-52.

Swindell, L., & Walls, W. (1993). Response confidence and the delay retention effect. *Contemporary Educational Psychology, 18*(3), 363-375.

Theide, K., & Dunlosky, J. (1999). Toward a general model of self-regulated study: An analysis of selection of items for study and self-paced study time. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25*(4), 1024-1037.

Thorpe, M. (1990). Using reflection in the development of learning. *Journal of Research on Computing in Education, 23*, 67-70.

Torkzadeh, G., & Koufteros, X. (1994). Factorial validity of a computer self-efficacy scale and the impact of computer training. *Educational and Psychological Measurement, 54*(3), 813-821.

Tweedle, S., Avis, P., Wright, J., & Waller, T. (1998). Towards criteria for evaluating web sites. *British Journal of Educational Technology, 29*(3), 267-270.

van Merrienboer, J., & de Croock, M. (1997). The Transfer Paradox: Effects of contextual interference on retention and transfer performance of a complex cognitive skill. *Perceptual & Motor Skills, 84*(3), 784-786.

Violato, C., Marini, A., & Hunter, W. (1989). A confirmatory factor analysis of a four-factor model of attitudes toward computers: A study of preservice teachers. *Journal of Research on Computing in Education*(Winter), 199-211.

Wild, M., & Quinn, C. (1998). Implications of educational theory for the design of instructional multimedia. *British Journal of Educational Technology, 29*(1), 73-82.

Wylie, M. (1999). *A Comparison of Reference Learning and Comparative Feedback Using Aircraft Recognition Multimedia Software with Military Personnel.* Unpublished master's thesis, University of Calgary, Calgary.

Zakrajsek, T., Waters, L., Popovich, P., Craft, S., & Hampton, W. (1990). Convergent validity of scales measuring computer-related attitudes. *Educational and Psychological Measurement, 50*(2), 343-349.

Zdunich, L. (1984). *Computer Inservice of teachers: The Medicine Hat Consortium* . Edmonton: Alberta Education.

Zhang, Y., & Espinosa, S. (1998). Relationships among computer self-efficacy, attitudes toward computers, and desirability of learning computing skills. *Journal of Research on Computing in Education, 30*(4), 421-436.

Zimmerman, B. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist, 25*(1), 3-17.

Appendix A

Microsoft Outlook 97 Content Evaluation Test

Knowledge Retention in Computer Based Training Evaluation

Your User ID: ________

Please answer the questions to the best of your ability. For the confidence questions, answer based on your confidence in answering the question to the left.

Start Time: __________

Answer Confidence

1. **The  button in the Journal folder enables you to record a journal entry.**
   True O False O
   very sure <---> very unsure
   O O O O O

2. **You must open the  Tasks folder to record a task you need to perform for a contact.**
   True O False O
   very sure <---> very unsure
   O O O O O

3. **The  button in the Print window displays your items as they would appear on paper.**
   True O False O
   very sure <---> very unsure
   O O O O O

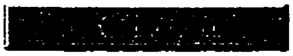
4. **The  Find window enables you to locate a specific item in a folder.**
   True O False O
   very sure <---> very unsure
   O O O O O

5. **If you display items by their category, those that have not been assigned to a category are not accessible.**
   True O False O
   very sure <---> very unsure
   O O O O O

6. **The  button in the Task window enables you to assign the task to someone else.**
   very sure <---> very unsure

True O False O | O O O O O

7. **The ■ button collapses a single group of categorized items.**
True O False O
very sure <---> very unsure
O O O O O

8. **The  button in the Categories window enables you to add and remove categories.**
True O False O
very sure <---> very unsure
O O O O O

9. **Items that are more than 30 days old should be deleted.**
True O False O
very sure <---> very unsure
O O O O O

10. **The  button indicates how much space your folder items are taking up on the Chevron network.**
True O False O
very sure <---> very unsure
O O O O O

11. **The  Deleted Items folder on the Outlook bar contains all items you have archived.**
True O False O
very sure <---> very unsure
O O O O O

12. **The Empty Deleted Items Folder option in the Tools menu archives all of the items stored in the  Deleted Items folder.**
True O False O
very sure <---> very unsure
O O O O O

13. **Through the Options window in the Tools menu, you can have your old items archived automatically.**
True O False O
very sure <---> very unsure
O O O O O

14. **The  button in the Task window specifies that your task is complete.**
True O False O
very sure <---> very unsure
O O O O O

15. **The Reminder box, in the Task window, specifies that you want to be reminded to record your item.**
True O False O
very sure <---> very unsure
O O O O O

16. **Each time you click a column selector above a field in the Information Viewer, the items are sorted first in △ ascending order, then in ▽ descending order.**
True O False O — very sure <---> very unsure O O O O O

17. **The Group By window in the View menu enables you to create groups of people to save as a distribution list.**
True O False O — very sure <---> very unsure O O O O O

18. **You can right-click a shortcut button on the Outlook bar to delete the button.**
True O False O — very sure <---> very unsure O O O O O

19. **The Add To Outlook Bar window in the File menu enables you to create a shortcut to a folder that exists on your PC.**
True O False O — very sure <---> very unsure O O O O O

20. **The button expands a single group of items.**
True O False O — very sure <---> very unsure O O O O O

21. **The button in any item window enables you to specify the folder you want to save the item into.**
True O False O — very sure <---> very unsure O O O O O

22 **You can copy an item to another folder by dragging it while you hold down the key.**
True O False O — very sure <---> very unsure O O O O O

23. **The button in the Journal folder displays time spent during the past one month.**
True O False O — very sure <---> very unsure O O O O O

24. **The Sort window in the View menu enables you to sort items on multiple fields.**
True O False O — very sure <---> very unsure O O O O O

25. **If you display your items in a *card* view, you can just click to sort your items in the Information Viewer.** — very sure <---> very unsure

True O False O — O O O O O

26. **When recording a journal entry for an activity that you expect to take less than 1 hour to complete, you should set the time in the Duration box in the Journal Entry window to zero, prior to clicking the [redacted] button.** — very sure <---> very unsure
True O False O — O O O O O

27. **The Filter window in the View menu enables you to display only those items in the folder that match specific criteria.** — very sure <---> very unsure
True O False O — O O O O O

28. **Through the File menu, you can create a new Outlook folder.** — very sure <---> very unsure
True O False O — O O O O O

29. **The button in the Journal folder automatically starts recording today's activities.** — very sure <---> very unsure
True O False O — O O O O O

30. **If you need to find a specific contact, you can use the button to search for them by their name, company, address, e-mail address, telephone number, etc.** — very sure <---> very unsure
True O False O — O O O O O

31. **The [redacted] button in the Journal Entry window stops the timer and records the time spent on the activity.** — very sure <---> very unsure
True O False O — O O O O O

32. **You must re-open the Task window to mark a task as complete.** — very sure <---> very unsure
True O False O — O O O O O

33. **A recurring task happens on an irregular basis.** — very sure <---> very unsure
True O False O — O O O O O

34. **You can click the top of the Timeline, then click a date in the calendar that opens, to move to another day in the  Journal folder.**
True O False O

very sure <---> very unsure
O O O O O

35. **If you delete a folder, the shortcut button will be deleted from the bar as well.**
True O False O

very sure <---> very unsure
O O O O O

36. **You can drag an item to another folder to quickly move it there.**
True O False O

very sure <---> very unsure
O O O O O

37. **The  button in the Filter window deletes the filtered items from the folder.**
True O False O

very sure <---> very unsure
O O O O O

38. **When you are recording an item, the  button enables you to categorize it.**
True O False O

very sure <---> very unsure
O O O O O

39. **You should archive old items that you do not want to delete.**
True O False O

very sure <---> very unsure
O O O O O

40. **You can enter the E command to select every item stored in the open folder.**
True O False O

very sure <---> very unsure
O O O O O

41. **You can use the  or  key to select multiple items in a folder.**
True O False O

very sure <---> very unsure
O O O O O

42. **You can double-click the shortcut button for a folder to specify that old items will be deleted automatically from that folder.**
True O False O

very sure <---> very unsure
O O O O O

43. **Through the Tools menu you can specify that old items should be archived automatically.**
True O False O

very sure <---> very unsure
O O O O O

44. **The total time spent working on a task is normally divided into 24 hour days.**
True O False O

very sure <---> very unsure
O O O O O

45. **You should archive items to drive P:**
True O False O

very sure <---> very unsure
O O O O O

46. **You can use the Import And Export wizard in the File menu if you need to retrieve an archived item.**
True O False O

very sure <---> very unsure
O O O O O

47. **To delete a shortcut button from the Outlook bar you can right-click it.**
True O False O

very sure <---> very unsure
O O O O O

48. **Through the File menu you can create a new folder.**
True O False O

very sure <---> very unsure
O O O O O

49. **You can right-click the shortcut button for a folder to open the folder into its own window.**
True O False O

very sure <---> very unsure
O O O O O

50. **When printing items in any folder, there are 2 print styles you can choose from.**
True O False O

very sure <---> very unsure
O O O O O

51. **The**  **button in the Print Preview window enables you to specify the number of pages you want to print onto paper.**
True O False O

very sure <---> very unsure
O O O O O

52. **If you use *Outlook* on a notebook computer, you can synchronize a folder so the information matches your real PC.**
True O False O

very sure <---> very unsure
O O O O O

53. **The Address Cards and Detailed Address Cards views of the**  **Contacts folder display index tabs that you can click to display specific contacts.**
True O False O

very sure <---> very unsure
O O O O O

54. **When recording a contact, you must type their company name if you want to use the  Address Book feature.**
True O False O

very sure <---> very unsure
O O O O O

55. **You know if a task has exceeded the due date because it is colored in blue.**
True O False O

very sure <---> very unsure
O O O O O

56. **If you set a reminder to start a task, the Reminder window appears at the designated time.**
True O False O

very sure <---> very unsure
O O O O O

57. **You can right-click a column selector for a field to group the items by that field.**
True O False O

very sure <---> very unsure
O O O O O

58. **If you want to maintain a list of only those contacts who work for a specific company, the *filter* feature would work best.**
True O False O

very sure <---> very unsure
O O O O O

59. **The *Word 97* application opens if you select the New Letter To Contact option from the Contacts menu in the  Contacts folder.**
True O False O

very sure <---> very unsure
O O O O O

60. **The  button in the Contact folder enables you to record a journal entry.**
True O False O

very sure <---> very unsure
O O O O O

61. **You can double-click on the right-hand side of any column selector in the Information Viewer to automatically adjust the width of the column.**
True O False O

very sure <---> very unsure
O O O O O

62. **You can type a task into the Information Viewer, without having to open the Task window.**
True O False O

very sure <---> very unsure
O O O O O

63. **The  button in the Notes folder enables you to record a contact.**
True O False O

very sure <---> very unsure
O O O O O

64. **The  button appears in the Task window so you can specify that the task is of high priority.**
True O False O

very sure <---> very unsure
O O O O O

65. **You can customize the current view to determine how your items will be sorted, grouped and filtered in the Information Viewer.**
True O False O

very sure <---> very unsure
O O O O O

66. **When copying a view, you must specify who will have access to it.**
True O False O

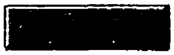
very sure <---> very unsure
O O O O O

67. **Once a *table* view is sorted by one field, you can hold down the  key while you click a 2nd column selector for a field, to sort your items by two fields.**
True O False O

very sure <---> very unsure
O O O O O

68. **The  button on the toolbar in the Contact window closes the window, without saving the item.**
True O False O

very sure <---> very unsure
O O O O O

69. **The  button in the Contact window enables you to type the name of your contact.**
True O False O

very sure <---> very unsure
O O O O O

70. **The  button in the Tasks folder enables you to record a task.**
True O False O

very sure <---> very unsure
O O O O O

71. **If you have closed the Outlook 97 program, you will know when you receive an e-mail message because the Windows task bar will display an icon.**
True O False O

very sure <---> very unsure
O O O O O

72. **Through the File menu you can delete all of the items stored in the**  **Deleted Items folder.**
True O False O

very sure <---> very unsure
O O O O O

73. **After you click the** [redacted] **button in the Print window, you can click on an area of your items to zoom in on them.**
True O False O

very sure <---> very unsure
O O O O O

74. **The**  **button enables you to move an item to another folder.**
True O False O

very sure <---> very unsure
O O O O O

75. **Through the Contacts menu in the**  **Contacts folder you can record several contacts from the same company.**
True O False O

very sure <---> very unsure
O O O O O

76. **The File As box in the Contact window enables you to file your contact as *Willow, David*, or *David Willow, or Imperial Furnace Cleaning, Willow*, etc.**
True O False O

very sure <---> very unsure
O O O O O

77. **You archive old items to a Personal Records (.par) file.**
True O False O

very sure <---> very unsure
O O O O O

Which image correctly answers this question:
78. **Which button lets you record the time spent performing your activities?**

very sure <---> very unsure
O O O O O

Check off ALL answers that complete this statement:

79. **The**  **button opens the** — very sure <---> very unsure

O O O O O

☐ Deleted Items folder
☐ Tasks folder
☐ Notes folder
☐ None of the above

Check off ALL answers that complete this statement:

80. **On the Status tab in the Task window, you can** — very sure <---> very unsure

O O O O O

☐ See the steps that you took to perform the task
☐ Specify the actual time you spent working on your task
☐ Specify the timeline for your task
☐ See the date you started the task

Check off ALL answers that complete this statement:

81. **The**  **button** — very sure <---> very unsure

O O O O O

☐ Moves the selected item to the Deleted Items folder

☐ Marks the selected item

☐ Moves the selected item to the Sent Items folder

☐ Opens the Deleted Items folder

Which image correctly answers this question:

82. **Which button stores the items you deleted?** — very sure <---> very unsure

O O O O O

Check off ALL answers that complete this statement:

83. **In the Define Views window, you can see the** — very sure <---> very unsure

O O O O O

☐ Dates the views were created
☐ Names of the existing views
☐ Types of folders each view applies to

☐ Types of views that were created

Check off ALL answers that complete this statement:

84. **You can create a file for archiving items** — very sure <---> very unsure ○ ○ ○ ○ ○

☐ By clicking the [redacted] button on the AutoArchive tab in the Options window
☐ On drive P:
☐ Once only
☐ As often as you want

Check off ALL answers that complete this statement:

85. **When creating a new view, you can choose from the** — very sure <---> very unsure ○ ○ ○ ○ ○

☐ Folder view

☐ Icon view

☐ Timeline view

☐ Card view

Check off ALL answers that complete this statement:

86. **The Go To Date window** — very sure <---> very unsure ○ ○ ○ ○ ○

☐ Lets you display a specific date

☐ Can be opened with the [redacted] D command
☐ Lets you type *next Tuesday* to move to next Tuesday
☐ Lets you type *Sally's birthday* to move to Sally's birthday

Check off ALL answers that complete this statement:

87. **The Define Views window in the View menu enables you to** — very sure <---> very unsure ○ ○ ○ ○ ○

☐ Create a new view of a folder
☐ Copy an existing view of a folder
☐ Move an existing view of a folder
☐ Modify an existing view of a folder

Check off ALL answers that complete this statement:

88. **The**  **button opens the**

very sure <---> very unsure

O O O O O

☐ Tasks folder
☐ Deleted items folder
☐ Inbox folder
☐ None of the above

Which image correctly answers this question:

89. **Which button lets you record the activities you need to perform?**

very sure <---> very unsure

O O O O O

Check off ALL answers that complete this statement:

90. **The**  **button opens the**

very sure <---> very unsure

O O O O O

☐ Outbox folder
☐ Notes folder
☐ Inbox folder
☐ Deleted items folder

Check off ALL answers that complete this statement:

91. **A task request**

very sure <---> very unsure

O O O O O

☐ Is a task you ask someone else to record
☐ Is a task you ask someone else to perform
☐ Is assigned by opening someone else's Tasks folder
☐ Is assigned via e-mail

Check off ALL answers that complete this statement:

92. **The**  **button opens the**

very sure <---> very unsure

O O O O O

☐ Tasks folder
☐ Notes folder
☐ Inbox folder
☐ Deleted items folder

Which image correctly answers this question:

93. **Which button lets you record the people whom you associate with?** — very sure <---> very unsure

O O O O O

Check off ALL answers that complete this statement:

94. **The  button in the Print Preview window** — very sure <---> very unsure

O O O O O

☐ Closes the open folder
☐ Closes Outlook 97
☐ Closes the Print Preview window
☐ Closes your communication services

Check off ALL answers that complete this statement:

95. **The Priority box in the Task window enables you to specify that your task has** — very sure <---> very unsure

O O O O O

☐ A Review priority
☐ A High priority
☐ A Normal priority
☐ A Low priority

Which image correctly answers this question:

96. **Which button lets you record your thoughts?** — very sure <---> very unsure

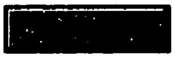
O O O O O

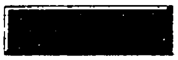
Check off ALL answers that complete this statement:

97. **If you set a reminder to start a task** — very sure <---> very unsure

O O O O O

The  button in the Reminder window deletes the task

The  button in the Reminder window deletes the reminder

The  button in the Reminder window deletes the task

The  button in the Reminder window opens the task

Check off ALL answers that complete this statement:

98. **When you are creating a folder** — very sure <---> very unsure

O O O O O

- ☐ You must specify what type of items it will contain
- ☐ You must specify which folder will be the parent
- ☐ A shortcut button is created automatically
- ☐ You must specify that you want a shortcut button created

Check off ALL answers that complete this statement:

99. **The  button** — very sure <---> very unsure

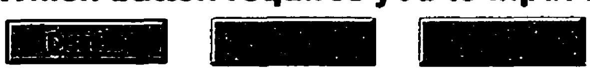
O O O O O

- ☐ Prints each page of items
- ☐ Prints the current page of items
- ☐ Prints each page of all folders
- ☐ Opens the Print window

Which image correctly answers this question: — very sure <---> very unsure

100. **Which button requires you to input a time?**

O O O O O



Finish Time:

Thank you for completing this evaluation. All results will be kept in strictest confidence.

Appendix B

Pre-training Survey

Knowledge Retention in Computer Based Training

User ID	____________		
Age	____________	Gender	____________
Do you have a computer at home?			____________
Do you have Internet access at home?			____________
How many hours a day do you use a computer?			____________
Approximate number of years using computers			____________

Put a check on the blank that best describes your opinion about computers.

Computers are:

1.	Unpleasant	__ __ __ __ __	Pleasant
2.	Suffocating	__ __ __ __ __	Fresh
3.	Dull	__ __ __ __ __	Exciting
4.	Unlikable	__ __ __ __ __	Likable
5.	Uncomfortable	__ __ __ __ __	Comfortable
6.	Bad	__ __ __ __ __	Good
7.	Unhappy	__ __ __ __ __	Happy
8.	Tense	__ __ __ __ __	Calm
9.	Empty	__ __ __ __ __	Full
10.	Artificial	__ __ __ __ __	Natural

Circle the choice that best describes your opinion.

SA= Strongly Agree S=Agree U=Undecided D=Disagree SD= Strongly Disagree

11. I have good computer support at work. SA A U D SD

12.	With computers it is possible to do practical things.	SA A U D SD
13.	I can learn by myself what I need to know about computing.	SA A U D SD

Circle the choice that best describes your behaviour.

EL= Extremely Likely L=Likely N=Neutral U=Unlikely EU= Extremely Unlikely

14.	Use a word processor.	EL L N U EU
15.	Use a computer on a regular basis.	EL L N U EU
16.	Identify basic parts of a computer and their functions.	EL L N U EU
17.	Elaborate on various computer applications in society.	EL L N U EU
18.	Teach someone to use a computer software package.	EL L N U EU
19.	Learn a software package you have never used before.	EL L N U EU
20.	Discuss strengths and weaknesses of various software packages.	EL L N U EU
21.	Use computer-aided instruction (teaching software).	EL L N U EU
22.	Install a software package onto a computer.	EL L N U EU
23.	Do a significant task on a computer.	EL L N U EU

Appendix C

Questionnaire

Participant Comment Sheet

Computerized Instructional Material was named: Profound Learning SWIFT

This is an anonymous comment form about what you thought of this process.
Please write any suggestions, problems, etc. you had with the process or the instructional materials.

Please place in the comment sheet box.
Thank you.

Appendix D

Post-Training Survey

Knowledge Retention in Computer Based Training   Post 30 Days

Username ____________

Circle the name of the instructional program you used.

(SWIFT   Profound Learning)

Circle the choice that best describes your opinion.

SA= Strongly Agree   A=Agree   U=Undecided   D=Disagree   SD= Strongly Disagree

1.	I found this program "user friendly".	SA	A	U	D	SD
2.	I think that appropriate level of detail is given through out the program.	SA	A	U	D	SD
3.	I think that appropriate feedback is given for incorrect answers.	SA	A	U	D	SD
4.	I liked this educational program.	SA	A	U	D	SD
5.	I would recommend this program to other people.	SA	A	U	D	SD
6.	I can access Outlook whenever I want.	SA	A	U	D	SD
7.	I have enough training to use Outlook effectively.	SA	A	U	D	SD
8.	I think that appropriate feedback is given for correct answers.	SA	A	U	D	SD
9.	I have good computer support at work.	SA	A	U	D	SD
10.	The educational program does a good job of teaching how to use Outlook.	SA	A	U	D	SD
11.	With computers it is possible to do practical things.	SA	A	U	D	SD

12. I can learn by myself what I need to know about computing. SA A U D SD

13. How often during the last month did you review the instructional material? Circle one.

Very Often Fairly Often Sometimes Seldom Never

Appendix E

Consent Form

Research Project: Knowledge Retention in Computer-based Training
Principal Investigator: Doug Reid BA, BEd

This consent form, a copy of which has been given to you, is part of the process of informed consent. It will give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something maintained here, or information not included here, please ask. Take the time to read this form carefully and to understand any accompanying information.

I am enrolled at the University of Calgary in a Master of Arts program. As part of the program requirements I need to conduct research to write a Masters' thesis. I would like to be able to carry out the research at the University of Calgary and the purpose of this form is to seek your permission for me to carry out this task.

The purpose of this research is to collect data to study the effects of computer based training on retention of knowledge over time. It is expected that through this research I will be able to discover the relative merits of various instructional methods.

Your participation is sought because you are currently involved with an instructional method that I will be examining. I am seeking to observe your learning and retention of knowledge in order to evaluate the instructional methods I am researching.

If you choose to participate in this study, you will be at no greater risk than what occurs in ordinary daily life. The benefits of participating in this study include adding to the knowledge that society has in regards to computer based training.

There will be a pre-test before you undertake any instruction. There will then be three post-tests. The first will be immediately following the instructional session. The second will be one month later and the final evaluation will be two months after the instructional session. After the evaluations, I will be reviewing all of the materials that I give you in order to form the basis of my research. You might also be asked to review the material for up to three minutes each day for the month following the instructional session. Participation in this study will involve a time commitment of approximately an hour and a half over the next 2 months.

In any writing or reports I do, I will maintain the anonymity of all participants and all instructional methods that I have researched. Dr. Michele Jacobsen and I will be the only persons, in addition to yourself, in possession of a signed copy of this consent form, and these forms, and any of the field notes that I may make during my research that may contain identifying information, will be kept secure. Any data I collect will be destroyed three years after the publication of the study.

Results of this study are intended for publication. I plan to write a paper for publication and my MA thesis about this study when I have completed my research. Any publication or public presentation of the results will include only data in the form of a group summary. No individuals will have their data singled out and identified.

If you have further questions related to this research, please contact:

Doug Reid at 235-2108 (dreid@ucalgary.ca) or Dr. Michele Jacobsen 220-4123 (dmjacobs@ucalgary.ca).

Research Project: Knowledge Retention in Computer-based Training

If you have any questions concerning the ethics review of this project, or the way you have been treated, you may also contact the Office Research Services and ask for Mrs. Patricia Evans, 220-3782. If you have any concerns about the project itself, please contact the researcher.

Declaration:

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject.

In no way does this waive your Legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities.

Participation in this study is voluntary.

You are free to withdraw from the study at any time. If you choose to withdraw, your data will be destroyed immediately.

The researcher can also terminate a participant's participation in this study.

Your confidentiality will be maintained, as well as all participants and all instructional methods that I have researched.

You will receive the results of this research study when it finished if you ask for them.

You are free to ask for clarification or new information throughout your participation.

Contacts:

Doug Reid at 235-2108 (dreid@ucalgary.ca) or Dr. Michele Jacobsen 220-4123 (dmjacobs@ucalgary.ca).

Participant (please print)

____

Participant (signature) Date

____________________________ ____________________________

Investigator/Witness Date

____________________________ ____________________________

A copy of this consent form has been given to you to keep for your records and reference.

Appendix F

Group A Participant Information Sheet

Participant Information Sheet

Name: ____________________ User ID: ____________________

The instructional process you will undergo is a self-paced learning environment. This is not a competition with anyone else. Please do not leave without arranging a time 30 days from now to write the 30 day and 60 day post tests.

As a user of the SWIFT instructional system, you will be taking an instructional CD with you when you leave here today. In order to get it to run on another computer, you must install it on that computer. There is no autorun option for this program. You have to go to the CD-ROM drive on that machine and run the .exe program on the CD-ROM. To use the program, you must have the CD in the computer. It will not work if the CD is not in the computer.

In case you have any questions about the instructional material, please email Vicky Anderson at diskover@home.com

In case you have any questions about the research study, please email Doug Reid at dreid@ucalgary.ca

Appendix G

Group B Participant Information Sheet

Participant Information Sheet

Name: ____________________ User ID: ____________________

The instructional process you will undergo is a self-paced learning environment. This is not a competition with anyone else. Please do not leave without arranging a time 30 days from now to write the 30 day and 60 day post tests.

As a user of the SWIFT instructional system, you will be taking an instructional CD with you when you leave here today. In order to get it to run on another computer, you must install it on that computer. There is no autorun option for this program. You have to go to the CD-ROM drive on that machine and run the .exe program on the CD-ROM. To use the program, you must have the CD in the computer. It will not work if the CD is not in the computer.

You have been asked to review the SWIFT material for 3 minutes a day for the next 30 days. When you write the 30 day post test, your review of the material can cease.

In case you have any questions about the instructional material, please email Vicky Anderson at diskover@home.com

In case you have any questions about the research study, please email Doug Reid at dreid@ucalgary.ca

Appendix H

Group C Participant Information Sheet

Participant Information Sheet

Name: ____________________ User ID: ____________________

The instructional process you will undergo is a self-paced learning environment. This is not a competition with anyone else. Please do not leave without arranging a time 30 days from now to write the 30 day and 60 day post tests.

As a user of the Profound Learning instructional system, you have been asked to continue using the Profound Learning System for the next 30 days. To do this on another computer, you will need to go to this web address: http://portal.modusoperandi.com/pls/

When you click "here" to launch PLS, type the user ID you have been given as your username and your password. For class, type chevron. You are in the Outlook 97 class. Please log-in to the Profound Learning system every day.

In case you have any questions about the instructional material, please email Vicky Anderson at diskover@home.com

In case you have any questions about the research study, please email Doug Reid at dreid@ucalgary.ca

Appendix I

Group Comparisons Pre-training for all starting participants (N=42)

	SWIFT A		SWIFT B		Profound		Significance
	(No Request)		(Request)		C		
	N= 15		N=13		N=14		
	Males	**Females**	**Males**	**Females**	**Males**	**Females**	
Gender	10	5	8	5	9	5	NS
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	
Computer at home	14	1	13	0	14	1	NS
Internet Access at home	12	3	12	1	13	2	NS
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Age	43.8	5.38	40.3	7.14	43.6	7.14	NS
Hours per day using computer	6.3	2.64	7.1	2.43	6.4	2.43	NS
Number of years using computers	13.1	7.54	13.2	3.95	18.6	6.56	.043
Opinion about computers	4.25	0.45	4.33	0.49	4.36	0.67	NS
Pretest Results	63.4	6.04	66.3	6.51	65.71	6.51	NS

Means and Standard Deviations for Pre-training variables by Group for all the participants who started the study.

Appendix J

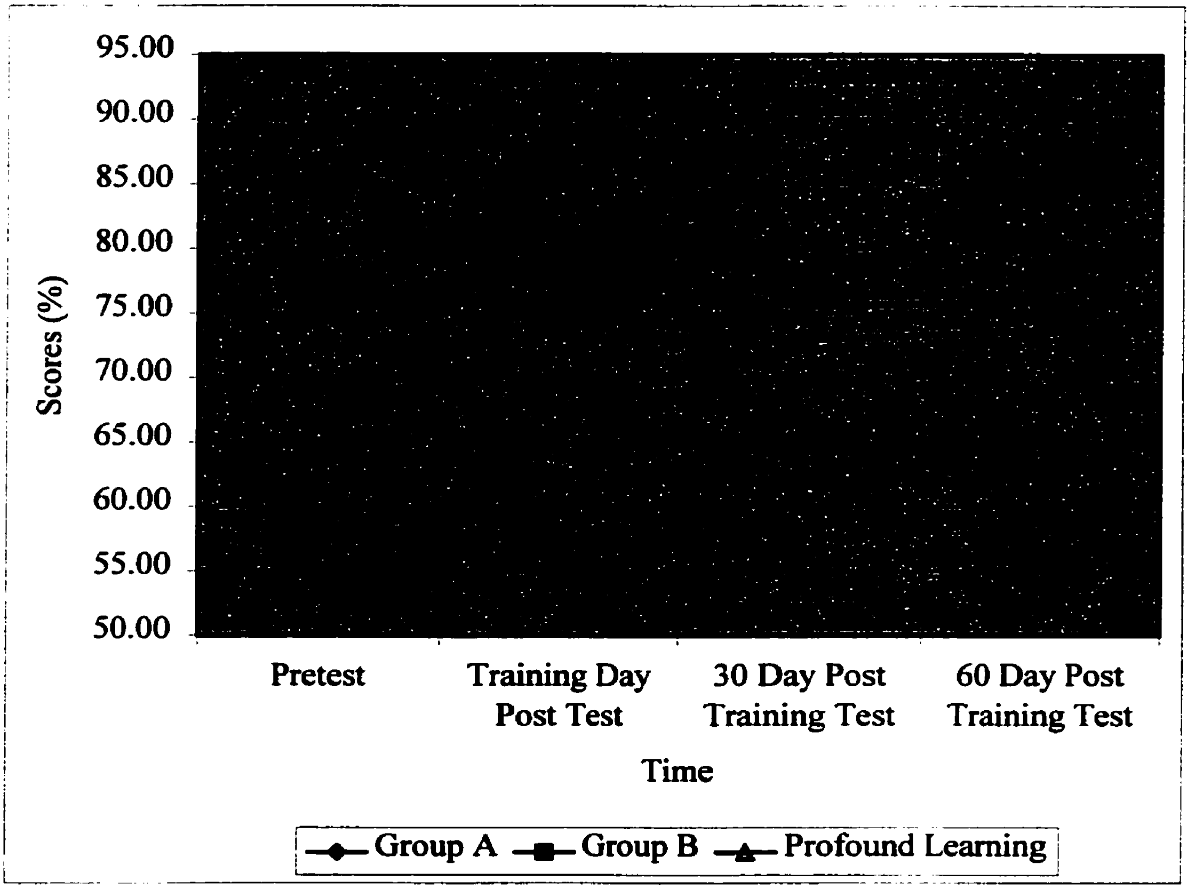
Means and Standard Deviations for all starting Participants

Means and Standard Deviations for all Participants					
		Pretest	Posttest 1	Posttest 2	Posttest 3
				30 day	60 day
SWIFT Group A	Mean	63.4000	75.0000	72.9167	70.0909
	N	15	15	12	11
	Std. Deviation	6.0451	8.7342	7.4889	5.7698
SWIFT Group B	Mean	66.3077	77.9231	75.5833	72.6667
	N	13	13	12	12
	Std. Deviation	6.5113	8.5388	7.1663	8.2719
Profound Learning	Mean	65.7143	84.5000	79.2727	79.3333
	N	14	14	11	9
	Std. Deviation	7.0866	6.6881	6.9006	2.8284
Total	Mean	65.0714	79.0714	75.8286	73.6562
	N	42	42	35	32
	Std. Deviation	6.5160	8.8384	7.4577	7.1645

Means and Standard Deviations for pretest and posttest data, on all participants who started the study.

Appendix K

Knowledge Retention Study All Beginners Group Scores (N=42)



Mean performance of the SWIFT (A), SWIFT (B) and PLS (C) groups across testing periods. This figure represents data from the participants who started the study.