University of Alberta

Assessing Computer Literacy in Adult ESL Learners

By

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Abstract

Despite enthusiasm for computer-assisted language learning (CALL), teachers in adult English as a second language (ESL) programs in Canada are often faced with the challenge of a wide range of computer literacy among students. The purpose of this study was to explore the possibility of using four measures: a computer experience questionnaire, a vocabulary self-assessment questionnaire, a computer skills self-assessment questionnaire and a written test of knowledge, as alternatives to a performance measure of computer literacy defined as "the machine level skills required by adult ESL students to use the computer for language learning activities." The data analyses show a high degree of reliability on all instruments. There was a strong correlation between all the measures and the Performance Test, except the Vocabulary Self-report Questionnaire, which had a moderate correlation. There was also a strong correlation between Computer Experience and the measures of computer literacy. This suggests that all the instruments could be used as a predictor of computer literacy skills.

This thesis is dedicated to:

The loving memory of my mother
Who was very much present during the entire project,
And whom I came to understand a little better because of it.

And

To all the adult ESL learners
With whom I have had the honor of working,
And whose voices are too often missing from the literature.

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Chapter 1

Introduction

"I'm afraid I will break it," a middle-aged female student from China told me as we discussed the use of the computer in our English as a second language (ESL) class. She was not alone. As is typical of adult education classes, the students in the class covered a wide range of skills, interests and abilities including computer skills. While a few students were quite familiar with computers, there were a number who had little or no experience with them, and some, like the woman above, felt a great deal of apprehension about using them.

This disparity of skill among the students often created havoc in lessons we attempted in the computer lab. Despite efforts to build in support for the weaker students, time in the lab was frequently gobbled up helping students navigate and troubleshoot. The first step in the lesson, opening the program, could sometimes take a large portion of the class time. Some students would not be able to find it, others would open the wrong program, and others would end up with error messages of one sort or another. The more experienced students would wait patiently as I ran around to all the students' computers helping them to get the program running so we could proceed with the lesson. This process became easier once we had a data projector and students could follow visual cues if they did not know how to do something, or if they knew how but were unable to follow the oral instructions because they did not know the English vocabulary. For students who had trouble controlling the mouse, however, this did not help all that much and the class was still held up as I dealt with those who could not successfully follow the verbal and visual instructions. Sometimes the lab time would almost be over by the time we were up and running. Then, we'd have to go through a similar process for saving and closing files. Like other teachers, I wondered if using the computers was worth the time and effort.

I soon learned that things went more smoothly if I spent time providing instruction related to the computer. Weaker students became more independent and confident when they learned and practiced controlling the mouse. The whole class benefited from time spent on computer-related vocabulary and on giving and following instructions because even the more experienced students often did not know the English vocabulary to talk about what they could do on the computer. As more time was spent on computer-related skills, however, the question of how appropriate it was to be teaching computer skills in the language class arose. Ours was, after all, a language program; we taught English, not computers, and precious time was being spent on activities that, to some, were not language-related.

Computers in ESL Classrooms

Computer technology has a place in the ESL classroom for a number reasons. First, the ability to use a computer is in itself a learning objective in a class that addresses culture and citizenship in Canada. Second, computers are a potential source of personal development, offering learners the possibility of developing skills and abilities unique to the computer environment. Finally computers can be used within certain teaching strategies to enhance the language learning process in the classroom.

For most adult ESL programs outside of Quebec and other francophone regions, culture and citizenship are integral objectives of classroom instruction. Students need to prepare to participate fully in Canadian society. One of the ways they need to prepare is to be able to communicate with both government and employers. This communication is increasingly done through the Internet and email. According to data gathered by Statistics Canada (2001a), 42% of Canadians were connected to the Internet at home in 2000. E-mail was identified as the number one computer activity for Canadians, with 88% of online Canadians accessing email many times a week and 62% on a daily basis. Students are often preparing to enter the work force and here, too, the need for computer skills is evident. Statistics Canada reported that 57% of employed people in Canada used a computer at their main job in 2000 and 80% of those used it everyday; that is 6.4 million Canadians using computers at work on a daily basis (2001b). The ability to use technology is clearly becoming an integral part of Canadian society in this age of information and therefore needs to be addressed in the ESL classroom.

Another argument for the inclusion of computers in the language classroom is the need to develop new skills that have only come into existence with the new technology. It has been suggested that just as bilingualism appears to have positive affects on certain aspects of cognitive functioning such as metalinguistic awareness (Baker, 2001), 'e-texting', reading hypertext, also leads to benefits such as increased cognitive flexibility (Meskill, Mossop, & Bates, 1999). The role of visual elements has become more integrated into the multimedia communication environments of today, which leads to different ways of seeing and relating to the world. Kress (1998) suggests that while sequence and temporal organization are the logic of writing, display and arrangement are the logic of the visual. The difference between the two, he suggests, is evident when one considers the very different perspective one gets from drawing a picture of an event versus writing a descriptive text of it. The opportunity to develop new skills and perspectives such as these will help students to participate fully in the wired world of today.

Finally, there has been great interest in the language learning and teaching community in the potential of computers. This is evident from the growth in technical literature on the topic and by the establishment of professional associations dedicated to the use of technology in language learning such as CALICO in North America, EUROCAL in Europe and WorldCALL. Computers are being used in a number of ways that reflect the principles of the Communicative Language Teaching (CLT) approach. The distinguishing characteristic of CLT is the focus on using language rather than on learning about language. Some of the principles of CLT that are instantiated in computer-mediated environments include:

1. Access to authentic communication
2. Opportunities to negotiate meaning
3. Focus on language function rather than form (Larsen-Freeman, 2000)

Language as it is used in real situations is the essential characteristic of the CLT approach. Computer technology provides opportunities to bring authentic language into the classroom in a number of ways. Authentic material from the Internet has been explored as a source of cultural information (Barrette, 2001; Osuna & Meskill, 1998), as an informational resource for content-based language teaching (Kasper, 2000), and for activities aimed at developing vocabulary and reading skills (Green & Youngs, 2001).

CLT involves purposeful interactions with opportunities for the negotiation of meaning. Purposeful interaction with others has been facilitated in tandem learning experiences through email (Appel, 1999) and discussion boards (Sotillo, 2000; VanHandle & Corl, 1998). An area of computer mediated communication (CMC) that has been the focus of a number of studies is the use of chat software used either on a local area network for pre-writing class discussions (Chun, 1994; Kelm, 1992; Kern, 1995; Sullivan & Pratt, 1996; Warschauer, Turbee, & Roberts, 1996) or on the Internet with native and non-native speakers (Kitade, 2000).

It is also generally accepted that learners engaged in communicative activities benefit from form-focused instruction which draws their attention to the structural aspects of the target language (e.g., Spada, 1997). Many CALL programs are designed to provide supportive features to help students with the structures of the language within a meaningful context (Klassen & Milton, 1999). Software programs such as a concordancer provide opportunities for learners to discover structural, stylistic and lexical patterns in the language (Cobb, 1997, 1999).

It seems that there is a legitimate place in the adult ESL classroom for the use of computers and the development of computer skills. While there is encouragement for this from a variety of sources, there seems to be very little guidance for language teachers in terms of the practical integration of the technology into language instructional activities. The fact that significant numbers of students in a class may not have basic computer skills is rarely acknowledged. With the rapid increase of computer use in recent years, it is often assumed that all students will have the basic skills when they come to class. This does not appear to be the case, especially among adult ESL students who are newcomers to Canada. A closer look at the statistics shows that what has been called the "digital divide" is present and growing both nationally and internationally. On the national level, for example, the use of technology is not evenly distributed across Canadian society; its use is related to income, education, gender and other factors. According to Statistics Canada (2001b), 80% of workers with incomes above $80,000 used a computer on the job, compared to only 36% of individuals with an income of less than $20,000. While 85% of workers with a university degree used a computer at work, only 41% of those with a high school education did so. On a global scale, we see the same disparity. A common measure of a country's level of technical development is the number of Internet Service Providers (ISP) they have. According to the World Fact Book 2002 (Central Intelligence Agency, 2002), in 2000 the United States had 7,800 ISPs, and Canada had 760 compared to Russia with 35, India 43, China with 3 and Cameroon with 1. Depending on where in the world immigrants to Canada come from, as well as what their economic and educational backgrounds are, they may have had more or less exposure to the technology explosion. This situation is not limited to the students. The fact is that some teachers are themselves lacking in computer skills and are therefore, reluctant to use them in their classrooms (Lam, 2000; Scott, 2001).

Many questions arise for today's practicing ESL teacher. What effect does the proliferation of new communication tools have on what it is to be considered literate in society? How does this influence the knowledge and skills that we teach in order to help ESL students become literate? How can computers help students develop language skills? How do we integrate the use of the computer into the language classroom? And most practically, what do we do about students who do not have the basic computer literacy skills required to use the computer? While placing itself within a framework of the broader issues of computer literacy and computers in the language classroom, this study is concerned with the last question: the computer literacy needs of ESL students. One way to approach the problem is to consider the situation from the perspective of instructional design.

Designing Instruction

Instructional design (ID) is a systematic approach to the planning, development, evaluation and management of the instruction process. One of many ID models is offered by Kemp, Morrison and Ross (1999) and involves nine elements that interact with each other in the design process. Figure 1.1 shows the nine elements within two circles that represent the processes that underlie the entire design process. These nine elements are not in a linear order; each interacts with the others and contributes to an overall process that involves ongoing planning and revision that is based on summative and formative evaluation.

The nine elements include:

- *Identifying the instructional problem* allows the designer to determine if indeed instruction is needed. One of the ways the problem can be identified is through a needs assessment where needs are considered to be "a gap between what is expected and the existing conditions" (Kemp et al., 1999, pg. 21).
- *Examining learner characteristics* includes consideration of such general characteristics as age, gender, ethnicity, experience and

educational levels of the learners. As well, prerequisite competencies of the learners and learning styles need to be considered.

- *The task analysis* identifies the content required to alleviate the performance need that was identified in the definition of the problem. The exact form a task analysis takes will depend on the type of knowledge and skills required as well as the specific context.

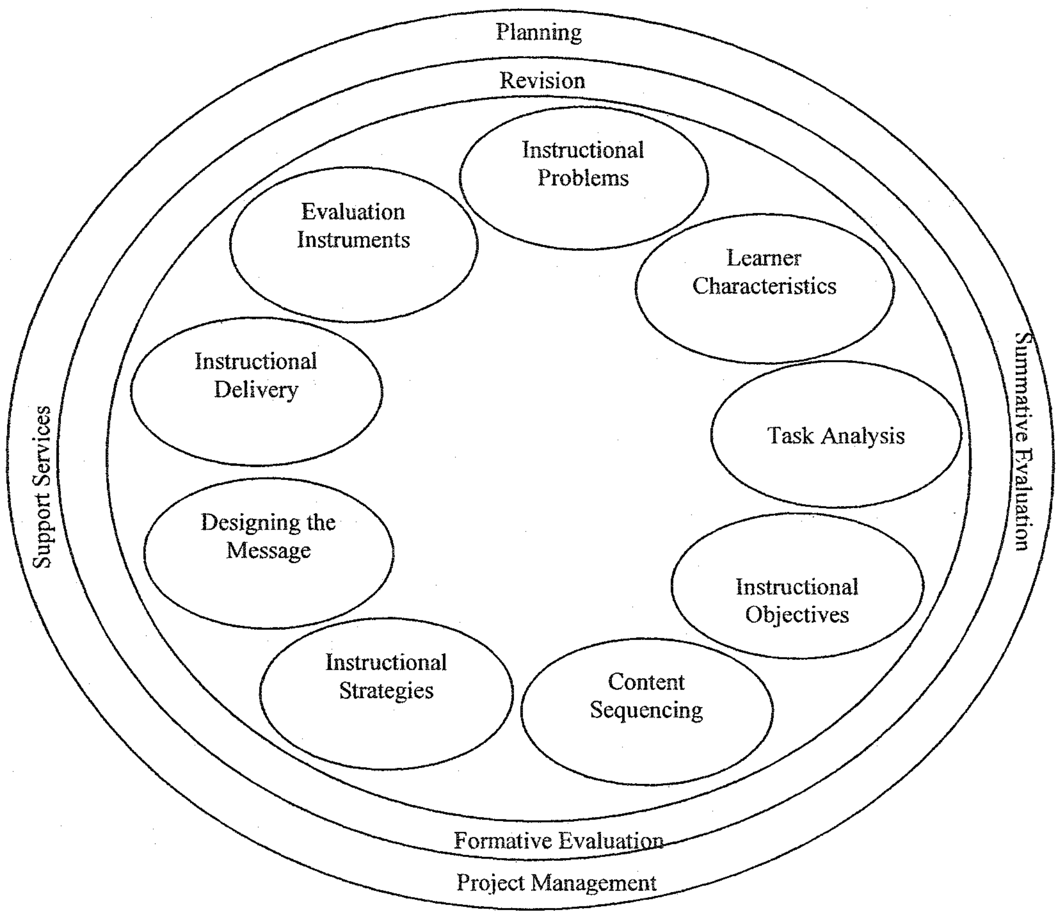

Figure 1.1 Instructional Design Model: Kemp, Morrison and Ross, 1999.

- *Instructional objectives* are clear statements of what the student is expected to learn. These are directly related to the content identified in the task analysis and provide the focus for instruction as well as guide the development of evaluation items and procedures. Objectives can be in the cognitive, psychomotor or affective domain.

- *Content sequencing* involves deciding the order in which to present instruction on the various objectives.
- *Designing instructional strategies* involves decisions on two levels. The first level requires identifying the general learning environment, which is usually defined in terms of the degree of individualization, instruction delivered to the class, a group or to the individual. The second element is choosing the teaching strategy that best fits the type of instructional objective.
- *Designing the instructional message* refers to developing the actual instructional material. This includes pre-instructional strategies such as using pretests, providing objectives, overviews or the use of advance organizers, as well as the lesson materials themselves.
- *Instructional delivery methods* include group presentation, self-paced, and small group formats.
- *Evaluation* is informed by the performance objectives and can be either summative or formative. Summative evaluation is generally done at the end of instruction and provides information about how successful the instruction was. Formative evaluation is used throughout the design process to provide information about how to improve the instruction. Formative evaluation can also be in the form

of a pre-test used to assess the readiness of a learner to undertake a particular course or topic and to determine which competencies a learner has already mastered and which will require instruction.

In applying this model to the ESL classroom, we begin with the perception that ESL learners lack the computer skills to engage in CALL activities. A needs analysis can help provide evidence of this gap by identifying the specific kinds of activities that students are likely to be asked to do on the computer, the prerequisite skills required to do those activities, and the students' current level of those skills. A task analysis is used to articulate what the prerequisite skills are. In order to assess which of the identified skills the students have mastered, instructional objectives, derived from the task analysis, will serve as the guide for development of an evaluation instrument. Characteristics of the learner, such as their diverse educational and cultural backgrounds, their previous experience with computers, their language proficiency and their current levels of computer literacy as reflected in the formative evaluation, will all need to be taken into account in designing instruction to address the need for computer literacy. While a number of elements are involved, this study essentially deals with the initial stage of clearly defining the instructional problem. This requires a needs assessment instrument that will allow the instructional designer to identify the gap between learners' present knowledge and what they are expected to know.

The outline of the thesis is as follows: Chapter 2 examines the literature on literacy and technology, and explores previous studies that have assessed computer literacy. Chapter 3 provides a detailed description of the development of five computer literacy assessment instruments including the task analysis and instructional objectives on which they were based. This chapter also provides an account of the methods used in testing those measures with adult ESL students. Chapter 4 presents the results of the analyses. Chapter 5 provides a discussion of issues relating to the assessment as well as implications for subsequent phases of the design process.

Chapter 2

Literature Review

This chapter provides a review of the literature related to literacy from the perspective of technology. It is divided into three parts. The first section provides an examination of the concepts of literacy and technology. This is followed by a review of previous research concerned with assessing computer literacy. The chapter concludes with the research questions for the study.

Literacy and Technology

Defining literacy is a daunting task due to the fact that study of the area is associated with "a variety of unconnected research and specialty camps" (Wagner, 1999, p. xi), and these camps are surprisingly insulated from one another. The addition of technology to the mix in the past few decades has unfortunately only further muddied the waters. There is, however, some agreement among scholars concerning two distinct theoretical approaches to the issue of literacy. This distinction has been variously labeled as traditional versus socio-cultural (Gee, 1992), autonomous versus ideological (Street, 1984), instrumental versus mediational (Jones, 1996), first versus second generation (Tyner, 1998). The first term of each pair describes literacy as a well-defined set of cognitive skills located in the individual, whereas the second term emphasizes literacy as a function of the social, cultural, economic and political context. Triebal (2001) describes these two approaches as "clusters of theories, and, while being different in their purport, they do not contradict each other" (p. 43). Researchers and scholars who concern themselves with technology and literacy can be similarly grouped. The distinction of cognitive versus socio-cultural perspectives serves as a useful framework for the present discussion, which aims to contextualize the notion of computer literacy within the wider notion of literacy.

Socio-cultural Perspective of Literacy

A socio-cultural perspective on literacy has been gaining popularity over the past few years (Gee, 1992; McKay, 1996; New London Group, 1996; Tyner, 1998). Those who view literacy from this perspective conceptualize it as a social phenomenon in which the meaning and uses of literacy practices are inextricably related to the social and cultural context within which the practice occurs. For them, literacy involves much more than the ability to read and write. It involves negotiating a plurality of 'literacies' that are related to the cultural, social, and political context of literacy events. While alphabetic literacy is seen as contributing to successful participation in society, this view emphasizes that, of itself, it is not a guarantee of success.

The study of technology and literacy from the socio-cultural perspective focuses on what people do with the technology. Proponents of this perspective see the computer as a tool for communication that provides access to and facilitates participation in a variety of discourse communities (Gee, 1992; New London Group, 1996). They focus on the emerging discourses that come with the new literacy tools made available through technology as well as those that exist in the social, political and economic context of the ever-shrinking global community in which we live. Literacy thus requires the ability to negotiate an even greater multiplicity of discourses. The term 'multiliteracies' has been coined by the New London Group (1996) to address what they see as the two aspects of the multiplicity of discourses today: the burgeoning variety of communication channels and media, and the increasing cultural and linguistic diversity within increasingly global societies.

Scholars from the socio-cultural perspective criticize approaches to literacy that study the psycholinguistic elements of reading and writing as being much too restrictive and narrow a focus. Similarly, studies that are concerned with computer literacy skills are seen as limited in their ability to address the broader notions of what has been called "electronic literacy" (Warschauer, 1999). Nonetheless, a basic level of technical competence is often assumed and sometimes referred to in socio-cultural discussions. For example, Tyner (1998) identifies computer literacy as what she calls a 'tool literacy' along with electronic and network literacy. What is not elaborated by these theorists, however, is what happens when the process gets bottlenecked by the lack of basic skills. A learner who wants to participate in various discourse communities needs to develop the ability to decode and produce text in order to read and write; similarly, a student wanting to use the computer to interact with an online community will need to have the basic skills required to use the machine. Issues of this nature need to be addressed at the cognitive level and are the focus of those who approach literacy from a cognitive perspective.

Cognitive Perspective on Reading and Writing

The cognitive approach to literacy focuses on the individual's development of reading and writing skills. One area of research seeks to understand the psycholinguistic processes that underlie these skills and to characterize intermediary levels of skill. Another area of interest is the relationship between literacy and cognition. For example Olson (1994) has highlighted how writing brings aspects of language into consciousness thus enabling the development of metalinguistic abilities. A third area adopts an historical perspective to chart the impact of literacy on the social, cultural and economic characteristics of society. One of the renowned works in this area is that of Goody and Watt (1968) who examined the invention of the alphabet and its impact on society in ancient Greece. The most relevant research within the cognitive paradigm for the present discussion is that relating to the psycholinguistic processes of reading.

Psycholinguistic research in the past few decades has provided us with clear descriptions of the components that underlie the complex skill of reading. Grabe (1991, p. 379-383) summarizes these components as follows:

1. Automatic recognition skills: the ability to automatically recognize features, letters and words without conscious effort.
2. Vocabulary and structural knowledge: knowledge of the language structure and recognition of vocabulary.
3. Formal discourse structure knowledge: knowledge about the organization of texts.
4. Content/world background knowledge: prior knowledge about the content of a text.
5. Synthesis and evaluation skills/strategies: ability to evaluate a text and to compare or connect it with other sources of information.

6. Metacognitive knowledge and skills monitoring: recognizing patterns and using appropriate strategies to accomplish specific goals such as skimming for specific information or guessing word meaning from context.

These component skills of reading can be approached in one of two ways, either bottom-up or top-down. The bottom-up approach emphasizes the textual decoding skills, while the top-down approach emphasizes the reader's background knowledge. Grabe reports on eye movement research that shows how the lower level sub-skill of word recognition, for example, occurs before higher-level context information can be utilized for comprehension of a lexical item.

From an instructional perspective, this research suggests the importance of developing automaticity in learners through instructional strategies such as reading rate and rapid recognition exercises as well as providing opportunities for extensive reading. Higher-level skills can be encouraged through the use of pre-reading activities and strategy instruction such as teaching students to recognize the organizational structure of text (Grabe, 1991).

Cognitive Approaches to Technology

As in general literacy research, cognitivist scholars in the area of computers and literacy have focused on the individual's development of a set of skills. One area of scholarly activity has been how the new technologies influence the print-based reading and writing skills, for example, the nature of digital text. One of the 'new' reading skills identified in the literature has been called 'parallel reading'(Burbules, 1998; Johnson-Eilola, 1998). On the computer, readers are required to process and manage multiple, parallel displays of information. With the use of multimedia, texts today are often "multi-modal semiotic objects" (Kress, 1998). That is they contain more than one semiotic mode; they include not just writing but visual and sound modes as well. This possibility of different semiotic modes can lead to different cognitive action, a different way of seeing and relating to the world. The different relationship between author and reader in hypertext and the non-linear organization of hypertext as well as the importance of critical reading in the WWW environment are other skills that have been the focus of these theorists (Burbules, 1998; Johnson-Eilola, 1998).

The cognitive approach to examining the complex processes of reading has been to break it down into component skills. This strategy has also been applied to computer skills. This area of study has been hampered by the fact that technology advances so quickly that the skills in question change before they can be studied in depth. For example, the term 'computer literacy' was first suggested by Luehrmann in 1972 to describe basic familiarity with computer programming. Soon after, with the introduction of the user-friendly graphical user interface (GUI), the need for programming ability decreased and the definition of what had come to be commonly known as computer literacy broadened to include the ability to choose and use appropriate software programs. Computer literacy skill sets have typically included long lists of knowledge about hardware and software applications as authors have attempted to include all of the quickly increasing capabilities of the technology. There has been a move recently to expand the focus to include more than simply technical skills. The Committee on Information Technology Literacy of the National Research

Council (1999) coined the phrase "Fluency with Informational Technology" or FITness, to refer to the knowledge and skills that a person must have in order to use information technology effectively and productively. They include three dimensions to FITness: intellectual capabilities such as reasoning and problem solving, conceptual knowledge such as understanding networks and information organization, and contemporary skills which include generic skills for a variety of uses of the computer such as word processing.

A limitation of the work in this area is an absence of information about the relationship between the component skills of computer literacy. Just as word recognition is a prerequisite for reading literature, mouse skills, for example, are a prerequisite for using a word processor. However, little research has been done to identify basic computer sub-skills that must be mastered before higher-level skills can be performed. Therefore, there is no well-established theoretical framework from which to assess sub-skills of computer literacy as there is for reading and writing. A hierarchical structure is implicit, however, in the descriptions of technology competencies that have been developed by such organizations as Alberta Learning (2000), the Committee on Information Technology Literacy of the National Research Council (1999) and the International Society for Technology in Education (1998). Table 2.1 shows the skills included in the contemporary skills component of FITness and the national standards for students established by the International Society for Technology in Education.

Although these descriptions of standards offer a starting point, the problem of how to define computer literacy for this study remains. Clearly all the skills identified in these standards are not relevant to the adult ESL classroom. Indeed, just as literacy has come to be understood as a function of context with degrees of proficiency levels along a continuum, so too with computer literacy. The NRC suggests that a person's FITness should not be assessed in terms of whether or not an individual has all of the ten capabilities, but that "people with different needs and interests and goals will have lesser or greater stakes in the various components" (1999, Chapter 2, p. 3)

Table 2.1 Computer literacy skills identified by two programs

Fluency with Informational Technology (FITness) *National Research Council*	National Educational Technology Standards for Students (NETS) *International Society for Technology in Education*
1. Setting up a personal computer	1. Basic operations and concepts
2. Using basic operating system features	2. Social, ethical and human issues
3. Using a word processor to create a text document	3. Technology production tools
4. Using graphics and/or artwork packages	4. Technology communication tools
5. Connecting to a computer network	5. Technology research tools
6. Using the Internet to find information and resources	6. Technology problem-solving and decision-making tools
7. Using a computer to communicate with others	
8. Using a spreadsheet	
9. Using a database	
10. Using instructional material to learn	

This study is concerned only with the prerequisite skills for use of the computer in the language classroom. One component, which appears in both lists, refers to the basic operations of a computer. These are obviously prerequisite skills for the other components and would therefore constitute the basic skills required by the adult ESL students. I will henceforth refer to these skills as "machine-level" skills. Computer literacy in this study is defined as those machine-level skills required for language-learning purposes within an adult ESL classroom.

Assessing Computer Literacy Skills

There is a small body of research in the educational literature dealing with the assessment of computer literacy. What is of particular interest for this discussion is the method of assessment used. Table 2.2 presents an overview of the studies I have been able to locate. The measures used in these studies reflect different operational definitions of computer literacy. For example, the early instruments included a measure of programming ability (Dologite, 1987; Kay, 1990), but since the mid-nineties, attempts to assess computer literacy have instead focused on the ability to choose and use appropriate applications (Jones & Pearson, 1996; Turner, Sweany, & Husman, 2000).

A variety of approaches and methods have been used to measure the identified computer skills. Table 2.2 gives an overview of some of the studies that attempted to create instruments to measure computer literacy. One of the most frequently used methods is a self-report. In fact, five of the six studies listed here used some form of self-report, often in conjunction with another type of measure. Self-reports may involve reporting one's opinions or feeling about something as in attitude questionnaires that ask respondents to agree or disagree with a variety of statements that express positive and negative feelings about technology. A self-report may also take the form of reporting one's behavior with items that require respondents to indicate how often they use email, or if they can do specific tasks. Self-efficacy questionnaires address the degree of confidence one has in his or her ability to do something on the computer.

Table 2.2 Previous assessments of computer literacy

Study	Participants	Exp.	S-R	Know.	Perf.
Murphy et. al. (1989)	414 graduate students, adult vocational students, and professionals learning to use the computer		X		
Kay (1990)	383 Education students	X	X		
Jones and Pearson (1996)	141 Business students registered in a computer course		X	X	
Eignor et al (1998)	99,773 TOEFL candidates	X			
Turner et al (2000)	498 undergraduate students registered in psychology courses	X	X	X	
Davies (2001)	700 undergraduates in an educational technology course	X	X	X	X

Note. Exp.=experience. S-R=self-report. Know.= test of knowledge. Perf.=performance.

In more recent attempts to measure computer literacy a written test has been used to measure explicit knowledge of skills believed to underlie computer literacy, usually in the form of multiple choice or true/false questions (Davies, 2002; Jones & Pearson, 1996; Turner et al., 2000). Very few studies have tried to directly assess practical computer skills, possibly because the implementation of a practical test is so troublesome. In her study of the ICT literacy skills of first year education students, Davies (2002) measured both knowledge and actual performance. Along with a student background survey, and a computer attitude survey, Davies administered a multiple choice knowledge test and a performance test, all delivered via the computer in one sitting. The practical component consisted of students following a number of written instructions provided on a handout and using files and folders provided by the researcher.

To sum up, previous research has favored the use of self-report measures which have been developed primarily for use with college level learners and administered in the students' mother tongue. This makes them unsuitable for adult ESL learners for a number of reasons: they require high levels of language proficiency, they often have an academic focus, and they target inappropriate computer skills targeted. Clearly, in order to evaluate adult ESL students' computer literacy skills, an assessment tool appropriate for the adult second language learner needs to be developed.

Research Questions

The task of creating an assessment instrument involves a number of considerations starting with identifying what is being evaluated. In this case, the focus of evaluation is a skill or a 'performance' as opposed to knowledge or attitudes, specifically the skill of using the computer for language learning activities. In choosing an assessment technique for evaluating a performance, Priestly (1982) outlines four questions that need to be considered.

- How will the information be used? Will it be used to assess the success of instruction (summative) or will it be used to inform instruction (formative)?

- Is the product or the process of primary importance? Is the focus of interest on the end product of the performance or is the process of the performance important?
- How authentic does the assessment need to be? To what degree does the evaluation need to approximate actual performance conditions?
- How directly do you need to measure it? Do you need to observe the skill applied in a real situation?

In the present discussion, the information from a measure of computer literacy will be used to inform instruction, that is, it is a formative as opposed to a summative evaluation. Essentially it will be used as a diagnostic instrument. Because of this need for detailed feedback, the process of the performance is more important than the product of the performance. If the student is unsuccessful on the task, just seeing the end result will not necessarily reveal where the skill deficiency lies. The most authentic and direct methods of evaluation are performance assessments where one observes the use of a skill in a real situation. This is the ideal, but constraints of time and resources in the classroom often make observation of performance impractical. In situations where the stakes are low, that is where misclassification do not have serious consequences, less authentic and less direct methods such as simulations, written tests or self-reports, may be more appropriate. Such is the case with a classroom diagnostic instrument. If a student's performance has been over or underestimated by the assessment instrument, the classroom teacher will have access to other sources of information, such as informal observation in class, and will be able to adapt instructional plans and strategies accordingly.

As was discussed earlier, indirect measures of computer literacy used in previous research include written tests of knowledge, self-assessment questionnaires and computer experience questionnaires. Since these measures rely heavily on language, it is possible that learners' knowledge will be underestimated. Therefore, in this study, a performance measure was used as a baseline to compare the accuracy of language-based measures.

Specifically my research questions are:

1. What is the relationship between a performance assessment of computer literacy and a written test of knowledge among adult ESL learners?
2. What is the relationship between a performance assessment of computer literacy and self-report measures among adult ESL learners?
3. How does computer experience relate to measures of performance, knowledge and self-report among adult ESL learners?

This chapter has provided an overview of the literature relating to technology and literacy from a socio-cultural and cognitive perspective. It has placed the current study within a cognitive framework, which identifies and examines the component skills of literacy events such as reading and writing but has been applied as well to the skills involved in using the computer. The definition of computer literacy used in this study is: the machine-level skills required for language-learning purposes within an adult ESL classroom. A review of previous studies that have assessed computer literacy provided some insight into the use of various instruments, however it was argued that these were not appropriate for use with ESL students. A computer literacy instrument needs to be created specifically for these learners. Considerations in developing an evaluation instrument were outlined and led to the statement of the specific research questions for the study.

Chapter 3

Method

This chapter describes the processes and the methodology used in the development of diagnostic assessment instruments for computer literacy skills in adult ESL learners. The first section describes a pilot study and is followed by a description of the task analysis that informed the later revisions of the instruments. The third section provides a description of each of the instruments. The chapter concludes with a description of the main study including a description of the participants, the procedure, the scoring and an overview of the analyses performed.

Pilot Study

The Instruments

In a pilot study (Meckelborg, 2002), a number of instruments designed to assess the computer literacy of adult ESL students were tested with a group of adult learners who were attending a low intermediate ESL class. The design of the various instruments (See Appendix A) was heavily influenced by the ICT literacy assessment conducted by Davies (2002). In her study of the ICT literacy levels of undergraduate student teachers, four different measures were used: a background questionnaire, a self-report, a written test of knowledge and a performance test. Each of these served as a model for a similar instrument, but because of the different target populations involved, significant changes were made both in terms of language and content covered.

The concern for confounding language proficiency and computer literacy was addressed in a number of ways in the development of the instruments. First, items from the instruments used in the Davies study were edited and the language was greatly simplified. For example the question: " A default FONT SIZE commonly used in word processors is..." (Davies, 2002) became "What size are the letters in the word *discussion*?" New items were written in the same simple language, avoiding computer-related vocabulary as much as possible. Vocabulary was addressed in a separate section on the written test. Graphics and screen shots were used to provide a visual alternative to text when possible.

As in Davies' study, Alberta Learning's Information and Communication Technology (ICT) outcomes (Alberta Learning, 2000) were used as a basis for the skills and knowledge to be assessed. The ICT curriculum is not designed to be delivered in isolation, but rather is intended to be integrated within the core courses and programs. This makes it especially applicable to ESL classes where technology also plays a supportive role in the course content. The ICT outcomes are organized into three categories:

- Communicating, inquiring, decision making and problem solving,
- Foundational operations, knowledge and concepts, and
- Processes for productivity.

General outcomes have been set for each category with specific outcomes established for divisions 1 to 4. Rather than using outcomes for division 4 (grade 12), the level used by Davies, outcomes for division 2 (grade 6) were used as a baseline because those for higher grades were believed to be beyond the average ESL student in newcomer language training programs. While it is useful to apply the general ICT literacy standards to the needs of the adult learners, not all the standards were appropriate for an adult ESL class, which might provide only 40 hours of instruction over a 10 or 15-week period. Also, the purpose of this assessment was to determine if the basic skill levels were present, not to assess the overall literacy levels of the students. The areas of computer literacy skills assessed were therefore limited to use of the Web, word processing, and basic system level navigation and file management. The following selected outcomes from two categories were used as the basis of the assessment:

- Foundational operations, knowledge and concepts
    - F6: Students will demonstrate a basic understanding of the operating skills required in a variety of technologies
- Processes for productivity
    - P1: Students will compose, revise and edit text
    - P5: Students will navigate and create hyperlinked resources.

Participants and Test Administration

Participants in the pilot were 11 students in an intermediate ESL class. They were asked to fill in an experience questionnaire consisting of 12 questions relating to their use of computers. They were also given a self-report questionnaire that included 15 items regarding attitudes to computers and 20 self-efficacy items that asked them to report how confident they were that they could do a number of simple tasks on the computer. As well, they were given a pencil and paper test that addressed what they knew *about* the computer. Finally they were given a performance test in the form of a hand out with a series of simple tasks to complete on the computer using files provided by the researcher.

The researcher visited the class four times over the course of one week. The first visit was a brief introduction and an explanation about the project. The following day, the researcher conducted a lesson on surveys to provide students with the opportunity to become more familiar with the rating scale. The students were then given the survey questionnaire to fill out. Students had a total of 50 minutes to fill in the questionnaire. Most were finished within 20 minutes. The next day, the written test was administered. It was presented as another form of a survey, simply to find out what people knew. Three days later, the researcher met the class in the computer lab for the administration of the practical component of the assessment. Using the overhead, the researcher guided the students to find and open the appropriate folder on their computer. The handout was distributed and the process of following and filling in the hand out was reviewed and demonstrated. Both the teacher and the researcher were kept busy with questions throughout the hour that had been allowed for the activity as it proved to be rather challenging for most of the members in the class.

Results of the Pilot Study

Results of the pilot provided directions for further investigation as well as a number of concerns. The attitude portion of the self-report was not significantly correlated to any of the other measures. All other instruments had significantly strong correlations except for the self-efficacy portion of the self-report which was not significantly correlated to the practical scores. It is possible that this reflects a method effect, as the other measures require a more analytical process than does the performance test. A high correlation (.87) was found between the written test and the performance component of the assessment suggesting that the written test may be an effective diagnostic tool. As the pilot was administered to only a small group of students, a more thorough testing was needed to confirm these results.

Practical Issues

The results of the pilot also suggested that the performance component of the assessment needed to be adjusted so as to be less discouraging for students. All students in the pilot took the entire hour allotted for the task and experienced a great deal of confusion and frustration. Consequently, scores were considerably lower on the performance compared to the written measure. Partly, this reflected the nature of the task, which asked students to follow a series of instructions on a written handout, a type of task with which they were not familiar and which placed greater processing demands on them. Given the wide range of skills in the group, typical of adult classrooms, it was also felt that some form of scaffolding needed to be incorporated so that all students could enjoy a measure of success.

Literacy practices within the adult ESL community were evident in the fact that students generally scored better on the Web related items (Written: 68%, Practical: 45%) than either word processing (Written: 54%, Practical: 35%) or system level items (Written: 54%, Practical: 32%). Since using the Web is probably the main thing students do with computers in their personal lives, this result is not surprising. The use of word processing for many is limited to school-related activities and unless they have been exposed to it in a classroom, their knowledge in this area is less developed.

A practical concern was the platform used for the assessment. Due to the dominance of Microsoft products on the market, students were unfamiliar with the Mac OS, which the pilot was based on, and so were additionally challenged by working within a different environment. This is clearly an example of how the economic and social context is closely interrelated with literacy practices. To accommodate this reality, it seemed more appropriate for the assessment to be adapted to and administered on the Windows platform.

Finally, there remained some concern with the confounding effects of language proficiency with computer literacy. Although effort was made to separate language issues from technical skill, it is not clear that this was accomplished. Keeping in mind that the purpose of measuring the student's computer skills was to identify whether or not the student is able to use the computer for language learning activities in the language classroom, the separation of language and computer skill became less critical. If the student can open the Edit menu but does not understand the words *Edit* or *menu* or even *open*, they will be as unable to follow the teacher's instructions as the student who does not know how to open a menu. This means the teacher will need to provide computer-related instruction before the student is able to proceed with the activity.

Before making changes to the instruments such as changing the format of the performance or shifting to a Window's platform, the content of the pilot instruments needed to be validated. Were the instruments actually measuring the skills that ESL students need in the language classroom? A task analysis was undertaken to determine exactly what those skills might be.

Task Analysis

As we saw in Chapter 1, a task analysis is a crucial element in the instructional design process. There are two main reasons for conducting a task analysis: to develop instruction for the tasks identified or to develop some form of assessment to see if a person has learned a specified task (Jonassen, Tessmer, & Hannum, 1999). The purpose of the current study is to develop an assessment tool that will serve both to assess adult ESL learners mastery of the basic skills required to use the computer for language learning activities and, in the process, to also identify instructional needs. Task analysis is a key part of the instructional design process because it ensures that what is ultimately assessed or taught is congruent with the identified learning outcomes (See Figure 1.1 p.8).

There are numerous methods of task analysis from which to choose, each lending itself to different kinds of activities, situations, and outcomes. Jonassen and Hannum (1991) distinguish two broad categories of task analyses, job task analysis and learning task analysis. Job task analysis is usually related to performance and mastery of specific skills. Learning task analysis, on the other hand is concerned with mastery of subject matter knowledge. While not employment related, this study concerns itself with the ability of students to perform certain tasks on the computer rather than their knowledge of computers. Therefore, a job task analysis method seemed more appropriate.

Another consideration in choosing a method of task analysis is whether you are working at a macro or micro level (Jonassen, 1999). In this case, the concern is not with the overall computer literacy levels of the students, but is limited to the very basic skills required to perform, or follow instructions for, specific activities. This called for a micro-analysis procedure.

Of the several possible common functions within the task analysis process, it is useful to identify those that will be important to a particular analysis. Jonassen, Tessmer and Hannum (1999) list five functions including:

1) Inventory tasks: identify all the tasks that need to be assessed or taught.
2) Select tasks for analysis: of the (usually) numerous tasks identified, select those tasks which are feasible or most relevant.
3) Describe or decompose tasks: break down the selected tasks into detailed component parts.
4) Sequence task components: determine the best instructional sequence.
5) Classify learning outcomes: describe the mental or behavioral performance required usually by classifying the type of learning that is required using various learning taxonomies.

The most important of these functions for this task analysis is the describing function. A method of analysis was required that would identify the physical and mental operations needed to complete the specified language learning tasks.

The method chosen for the study was a procedural analysis process. This method focuses on observable behavior and describes the procedure or steps required to complete a task in the form of a flow chart. This fits within a job analysis framework, keeping attention on the student's ability to accomplish a task rather than his or her knowledge of the domain. Procedural analysis can be performed at a micro level, with larger task components being broken down in separate, more detailed flow charts. The descriptive focus of this method allows for branches, loops, and decision points to be included in the analysis, and while not everyone will necessarily follow the exact same sequence, a "general model of competent performance"(Jonassen et al., 1999 pg. 47) can be generated.

First, the tasks needed to be identified. In considering all the computer assisted language learning activities discussed in the literature, it was obvious that many CALL activities are not appropriate for the adult ESL classroom, either because of language level, time required, or the nature of the language involved. For example, Internet searches that required the ability to use search engines and evaluate web sites involved both language and computer skills not yet available to students at this level. Also, it was felt that focusing on any specific language learning software would be limiting, and therefore universally used programs seemed more appropriate. Based on personal experience as a teacher in an adult ESL program, two of the most common activities used in adult ESL were identified: writing with a word processor, and getting information from or using resources on a specified web site. In order to successfully accomplish these tasks, students would need to demonstrate a basic level of skill with the computer, which would be the focus of the assessment. A hypothetical lesson plan, incorporating both of these skill areas was designed and used as the basis for the task analysis.

In the first activity of the hypothetical lesson, students are asked to write a paragraph on the topic or theme being covered in class. This would be entered and edited in a word processor and saved with basic formatting such as double spacing, and a centered title. The second activity asks students to use a resource on the Web: The Compleat Lexical Tutor (Cobb, 2002). This site provides a variety of resources for vocabulary building using frequency word lists as a basis for testing and developing vocabulary. It includes concordancing software as well as the ability to analyze text for vocabulary and create exercises. The hypothetical lesson plan calls for the students to access the site and take the vocabulary tests to determine their current level of vocabulary development. They would be encouraged to use the 'learn and practice' activities on their own. For this lesson, students are asked to enter their previously saved paragraph to have it analyzed for the vocabulary level they were using. Results of the analysis are compared to the current level of vocabulary development identified by the tests and are saved for discussion with the teacher. Thus, this lesson plan resulted in two tasks to be analyzed:

1. To create and save a word processing document with the following formatting: double-spaced, title centered, underlined, and in size 14, with name in the top right hand corner,
2. To test vocabulary level and compare that level to the level used in a current piece of writing using The Compleat Lexical Tutor.

Working through the lessons, I outlined all the steps involved. This was then put into flow chart form. Each of the components of the flow chart was then analyzed in the same way, resulting in a number of smaller flow charts with detailed steps. (See

Appendix B for examples). An expert user was observed completing the assigned tasks in the lessons and his performance was compared to the flow charts to confirm their accuracy.

It quickly became apparent that the multitude of ways to do one thing on the computer would need to be addressed. Since students use different computers in labs and at home, it was impossible to predict what computer configurations they would be used to. If a student could start a program from a shortcut placed on the desktop of their computer at home, would that student be able to start a program on the lab computer where no shortcut was available? It was decided to assume the most common denominator for computer settings. That is, all shortcuts would be removed from the desktop, including the button bar, forcing the student to use the longer, but more universal, menu commands. It was believed this would give a better indication of the student's familiarity and understanding of the computer.

Next to each component of the sub-task flow charts, vocabulary and skills involved in the step were itemized. A list of tasks was then generated with sub-tasks categorized into Web, word processor, and system related tasks, along with what the student would need to know or be able to do in order to accomplish the sub-task.

This list was used to generate the following performance objectives:

1. **Word Processing**: The student is able to enter, save, and manipulate text:
   1.1. Edit text: delete, insert, move, cut, copy, and paste text.
   1.2. Apply formatting: line spacing, alignment, font, size and style.
   1.3. Save a document with a name in a specified location.
   1.4. Save changes to a document.

2. **Web**: The student is able to access and navigate a specified web site:

    2.1. Go to a website, given a URL.

    2.2. Save and use Favorites or Bookmarks.

    2.3. Follow links.

    2.4. Use the navigation bar to move around a website.

3. **Windows**: The student is able to navigate a Windows platform:

    3.1. Start and quit programs.

    3.2. Manage windows: minimize, restore, maximize and close.

    3.3. Find folders/documents.

    3.4. Open folders/documents.

    3.5. Scroll.

    3.6. Select commands from a menu.

    3.7. Highlight text.

    3.8. Delete/insert/replace text.

4. **Mouse**: The student is able to control the mouse: point, click, drag, double-click.

5. **Typing**: The student demonstrates familiarity with letters, punctuation and the keys: shift, space bar, delete or backspace and enter.

The Revised Instruments

The objectives identified in the task analysis can be defined as educational objectives in that they describe what students are expected to be able to do "in a specific domain of knowledge, skills, or abilities" (Brown & Hudson, 2002 p. 36). They provide a clear description of the computer literacy skills that are needed in an adult ESL class. They are performance objectives, that is, they focus on the ability to perform or accomplish a goal (Brown & Hudson, 2002), and they are stated in terms of observable performances. These performances then become the focus of assessment.

Assessment can take the form of norm-referenced or criterion-referenced tests. In criterion-referenced testing, a student's performance is tested against a set of specific objectives rather than their performance being tested relative to that of other students as is the case in norm-referenced testing. This means that criterion-referenced tests are more useful when feedback on specific objectives is required as in the case of this study. It also means that objectives are at the heart of criterion-referenced testing. They serve as the basis for the development of test specifications, which are then used to guide the development of the test items. Following the suggestion of Brown and Hudson (2002), the following test specifications were developed:

Adult ESL Computer Literacy Assessment

> The assessment will include a self-report, a written test of knowledge and a performance test designed to evaluate the basic computer literacy skills required in order for students to use computers for language learning activities in an adult intermediate ESL classroom. Students who master this test are capable of using the computer for language learning activities with little or no computer-related instructions. The test covers the use of a word processor and a web browser as well as those system level skills required to work with these programs.

> Mastery means a student is able to type, control the mouse and carry out the processes required to a) create, manipulate and save documents and b) access and navigate a specified web site.

Having thus defined the framework for the test instruments, the content of the pilot instruments was analyzed in relation to the list of objectives, and the test specification. A number of important elements appeared to be missing and many unrelated and more advanced items, such as using the text ruler to set alignment, were found to be included. Consequently a substantial number of items were eliminated. Those items that remained formed the basis of the new instruments and items were created and edited where needed.

Computer Experience Questionnaire

The Computer Experience Questionnaire was combined with the Computer Skills Self-assessment Questionnaire to form one test form for ease of administration. This was called the Computer Literacy Questionnaire (See Appendix C).

The Computer Experience Questionnaire required students to select a response to a series of 12 questions about their experience with computers. Most questions were in a yes/no format with three questions regarding frequency in a Likert-type scale. Questions in the left column were to be answered by everyone; the right column was to be used by those who answered *yes* to the question on the left. Question 3 was reworded for clarity after the administration of the test with the first group. (*How often do you use it?* Was changed to *How often do you use your computer?*)

For scoring purposes, a *yes* to a yes/no question was assigned one point. The frequency scales were assigned one point if they reported a frequency of more than once a week. The maximum score possible was 12.

Computer Skills Self-assessment Questionnaire

The Computer Skills Self-assessment Questionnaire was included as Part 2 of the Computer Literacy Questionnaire (See Appendix C). Students were asked whether or not they could do 29 specific tasks on the computer. Language was kept as simple and as generic as possible, avoiding computer jargon. Pictures and screen shots were included for each of the items to help clarify what was being asked. A "*Yes/ No*" answer format was chosen over the self-efficacy scale used in the pilot to keep the instrument as simple and as familiar as possible. Students checked off their answer to each question selecting either *Yes, I can; No, I can't;* or *I don't understand*. The third response was included as an option for students who did not understand the vocabulary or did not understand the concept. Three items were removed after the first administration of the questionnaire, leaving a total of 26 questions.

Written Test of Knowledge

The Written Test of Knowledge (See Appendix D) was also divided into two parts, one focusing on skills and the other on vocabulary. The skills section provided a number of pictures of a computer screen and asked the student either to identify the location on the screen of the next mouse click required to do a specific task or to provide information from the screen. For the ten questions about the location of a mouse click, students were asked to draw a line from the question to the correct location on the picture. For the 10 information questions students were asked to write a word or phrase in the space provided. Again there was an attempt to keep the language simple and free of computer jargon.

The vocabulary section consisted of 20 matching questions. Students were provided with either a written definition to match to a series of words or a graphic to label from a list of words. Responses were entered by either drawing a line from the word to the answer or by writing a word in the appropriate blank. For both sections of the Written Test of Knowledge, one point was assigned to each correct answer for a possible total of 40.

Vocabulary Self-assessment Questionnaire

Included as the last item on the Written Test of Knowledge was a short self-report questionnaire for computer-related vocabulary (See Appendix C). This consisted of 20 vocabulary items that emerged from the task analysis process as being important vocabulary. Students were asked to indicate if they knew the word, if they had heard the word but weren't sure what it meant, or if they didn't know the word. They did this by placing a checkmark in the appropriate column next to each vocabulary item. The Vocabulary Self-assessment Questionnaire was scored with one point for each word the student reported that he or she knew for a total of 20 points.

Performance Test

The Performance Test was administered individually. The student was given oral instructions for a series of consecutive tasks on the computer. These included opening Microsoft Word, entering text, saving the document, opening Internet

Explorer, going to a web site, copying a paragraph from the web site and pasting it in the previously saved document, saving the changes and closing all programs. If the student could not complete a task, a prompt was provided in the form of simple oral instructions as needed. Support material in the form of screen shots for each step and written instructions were also available (See Appendix E for a sample). If the student could still not accomplish the task after being prompted, direction and demonstration was provided thus ensuring that all students were successful and able to move through each of the tasks. Instructions were simple sentences and, except when necessary, included only one instruction per item. An example of an exception to this was the item that asked students to save a document with a specified name in a specified folder. Computer jargon was avoided as much as possible.

Observations were noted on a checklist (See Appendix F), which broke each task into its sub-skills. A checkmark was used to indicate if the task and its sub-skills had been completed, and if the student had been *prompted* or *directed*. Prompted was defined as being provided with a standard verbal command and/or shown the corresponding visual cue. For example they might be given the command "Open the File menu" or they might be shown a visual with the command and a picture of the File menu open. Directed was defined as being provided step-by-step, detailed instruction, for example, "See the word file in the top left corner? Click on that." A rating scale of 1 to 3 was used to rate the degree of hesitancy with which they carried out each task. A 1 meant there was no hesitancy and their movements were smooth, confident and quick. A 2 meant they were somewhat hesitant and a 3 meant there was a great deal of hesitancy and their movements were very slow and/or awkward. Audio recordings of the Performance Test were made with the first group.

Main Study

Participants

Participants for the study consisted of 46 students from three intact adult ESL classes at two institutions in a large urban center in western Canada. The classes were working at Canadian Language Benchmarks (CLB) 3 and 4. These are referred to as the *Adequate basic proficiency* and the *Fluent basic proficiency* levels within the *Basic Proficiency Stage*, or *Stage I*, of the CLB. According to the CLB, learners who achieve Benchmark 8, at the end of Stage II, "demonstrate professional and academic 'readiness'" (Pawlikowska-Smith, 2000 pg. 2). In general terms, then, we can consider these students to be functioning at a high beginner or low intermediate level.

Two classes from one institution participated in the study: a morning class that met everyday for 3 hours and a night class that met 3 times a week for 3 hours. Five students from another split-level class in the evening joined with the participating class and are considered one class. The third group was from a different institution and met twice a week for one and a half hours. This was a conversation group made up of a mix of students from three same-level classes that met everyday for 3 and a half hours.

Participants included 30 females and 16 males. Due to confidentiality issues, detailed biographical information was not available for all participants. However, the classes are typical of adult ESL students with ages ranging from 17 to mid-50's. Over half came from South East Asia, including China, Vietnam, Korea, Japan, Cambodia, with the others coming from Central and South America, Eastern Europe, Africa and India. Most had been in Canada less than two years although some had been here longer.

Procedure

Arrangements were made with the classroom teachers for me to visit each class several times over a period of two to three weeks. The first visit, usually about 20 - 30 minutes, involved providing students with information about the study and asking them to sign consent forms. Each item on the consent form was discussed to ensure comprehension. Those who did not wish to participate in the study were provided alternate activities by their classroom teacher.

The Computer Literacy Questionnaire was usually filled out at a second visit that also lasted about 20-30 minutes. The first few questions on Part 1, the Computer Experience Questionnaire, were discussed to model the flow of questions. For example, if the student answered *No* to the first question, then he or she did not have to answer questions 2 and 3. The example in Part 2, the Computer Skills Self-assessment Questionnaire, was discussed and the options explained. Students were not permitted to use dictionaries or to ask each other for help but were encouraged to ask the researcher or the teacher for help if they needed it. In one group the first and second visits were combined into one longer time frame.

The Written Test of Knowledge was administered during a subsequent visit and took about 30 - 40 minutes. Students were reminded that although it looked like a test, they could not pass or fail. They were to consider it more of a survey. They were told that they could guess if they were not sure, or leave questions unanswered if they had no idea. Instructions were explained and an example done together as a group. Again, students were not permitted to use dictionaries or to ask each other for help but were encouraged to ask the researcher or teacher for help if they needed it.

The Performance Test required from three to six visits depending on the length of time available for each visit, the teacher's schedule, the number of students, and the skill level of the students. Usually these followed immediately after the Computer Skills Self-assessment Questionnaire and the Written Test of Knowledge visits. However, for one class there was a two-week interruption for the Christmas holiday and the Performance Test was completed in the first two weeks after the break.

Each student was pulled from class for 10 to 20 minutes to do the Performance Test with the researcher in a separate room. A laptop computer was used thus ensuring that all students would be starting from the same configuration regardless of the school or class they were in. This also allowed for greater flexibility in terms of access to a computer since we did not have to fit into the school lab schedule. To avoid the logistical problem of having access to the Web, a simple web site was designed for the activity and stored on a separate drive on the laptop.

The students were told that they would be asked to do a number of things on the computer and were reassured that it was not a test. If the student did not know how to do something or did not understand something, he or she was instructed to indicate this and the researcher would then help them by explaining or showing them some pictures.

Each instruction was given in a simple sentence and the student was given a brief time to respond. The items that included more than one task, such as saving the document with his or her name and putting it in the teacher's folder, were flagged by a comment such as "*OK, this next one is a big one, you have to do three things.*" If the student could not respond, the instruction would be repeated with some minor clarification, for example an emphasis on a key word. If the student was still having problems, the researcher would ask if the student knew how to do the requested task. Usually the student would say no, and the researcher would then provide a set of instructions to complete the task. Sometimes the student would be able to complete the task on his or her own after only one or two steps were provided. If the student was not able to follow the oral prompt, a screen shot of the step was available to provide visual cues. If the student was still unable to complete the step, directions were provided sometimes verbally, "*File is at the top in the left hand corner,*" sometimes physically, for example by demonstrating how to highlight text or what to do when you run out of room on the mouse pad. As each task was completed, the researcher checked off the appropriate column on the checklist and made notes about the problems or alternate routes a student used.

Scoring

A number of missing and spoiled answers on the Computer Experience Questionnaire had to be dealt with before final scoring was done and results could be generated. There were nine questionnaires with a total of eleven unanswered or spoiled items. Each one was considered individually and when possible, information available from the Performance Test or from other answers was used to assign a score for the item. Appendix G lists the problematic items and provides the rationale for each decision.

The Computer Skills Self-assessment Questionnaire was scored with one point for each *Yes, I can* and zero points for each *No, I can't* or *I don't understand* for a possible total of 26 points. Two items, #1 and #3, on one questionnaire (Participant 16), were spoiled by having both *Yes* and *No* answered. Upon consideration of the first item, it was fairly clear that the *No* had been crossed out and since 95% of respondents had answered *yes* to this question, the item was assigned a score of 1. No information was available for clarifying item #3, so it was entered as missing data.

The Performance Test was intended to take no more than 10 minutes. The initial version consisted of 21 items and students were encouraged to try to explore options if they were not sure of something. However, when it was administered with the first two students, it was evident that it was too demanding as it took them 30 and 40 minutes to complete. A number of formatting and web navigation tasks were eliminated to reduce the number of items to ten, which resulted in a total of 30 sub-skill items. The style of the test was also made more directive with less time allowed for trial and error. This revised version took between 10 and 20 minutes to complete depending on the student's skill level, with more computer literate students taking as little as five minutes.

Between the visits to the first and second classes, minor changes were made to the observation checklist, rearranging the columns for ease of use and separating out one step for clarity. Originally the column labeled "prompted" was a text box for the observer to make note of the kind of prompting that was provided, be it a simple verbal instruction or clue, a visual aid in the form of a screen shot or a physical gesture, or actual teaching or demonstration of the skill. This lack of standardization proved to be cumbersome when filling in the checklist and the information gleaned was of questionable value. The issue really was whether they could do the task alone, whether they needed help or, whether they needed instruction. The checklist was revised to provide simple yes/no columns for *prompted* and for instructed, which was called *directed* to avoid confusion with oral prompts in the form of simple instructions. This change did not create scoring difficulties because the changes involved collapsing previous distinctions into one category. Using the audio recordings of the Performance Test and the original checklist, a copy of the revised checklist was easily filled in for each participant in the first class. Of the two students who had done the original, longer version, one student's data had to be removed from the data set, as there was not enough information available to make the necessary judgments. The other student had been very vocal and animated during the activity sometimes actually thinking aloud and verbalizing her processes. This meant it was easy to fill in any information missing in her observation checklist from the audio recording.

Scoring for the Performance Test involved a number of considerations including whether a student had accomplished the task independently, with a prompt or with direction as well as the degree of hesitancy with which the task was completed. First a score between 0 and 3 was assigned to each of the 30 items on the observation checklist by placing the learner's performance onto a scoring grid that accounted for hesitancy as well as being prompted or directed (See Tables 3.1and

3.2). A total score was obtained simply by adding up the score for each of the 30 sub-skills for a possible total of 90.

Table 3.1 Scoring of items on the Performance Test

Prompted	Directed	Completed	Hesitancy	Score
		X	1	3
		X	2	2
		X	3	1
X		X	1	2
X		X	2	1
X		X	3	0
	X	X	1-3	0
		0	1*	2
		0	2*	1
		0	3*	0
		0		0

* They did something other than what was asked. For example: double-clicking instead of clicking.

Table 3.2 Scoring of typing on the Performance Test

Prompted	Directed	Completed	Hesitancy	Comment	Score
		X	1	*Fast, shift, keyboard*	3
		X	2	*Slow, shift, keyboard,*	2
		X	3	*Very slow, no shift,*	1
X		X	1		1
X		X	2		1
X		X	3		0
	X	X	1-3		0

Analysis

The first step in the analysis was to examine the various measures to determine the overall reliability of the data collection instruments. An item analysis was carried out for each of the measures of computer literacy to examine how individual items were functioning and to reveal any weaknesses that may be influencing results. Reliability estimates were also done for each of the instruments using Cronbach's alpha as an estimate of internal consistency.

Students' total scores on each of the measures were calculated and recorded. Results on the various measures were correlated using Pearson's Product-Moment Correlation to determine if there was a relationship among them. Specifically, the correlation between the Written Test of Knowledge of knowledge and the Performance Test, and between the two self-assessments and the Performance Test were examined. In addition, the Computer Experience Questionnaire score was correlated to all other measures to examine the nature of the relationship of Computer Experience to computer literacy. Items on the Computer Experience Questionnaire were also examined individually by correlating them to the scores on the Performance Test using Spearman's rank order correlations.

Those instruments that were referenced to the objectives, the Computer Skills Self-assessment Questionnaire, the Written Test of Knowledge and the Performance Test, were also scored by objective and students' scores for each objective were calculated and recorded.

This chapter began by describing and reporting the results of a pilot study of the instruments that were later used in the main study and provided a detailed description of a task analysis procedure that was used to validate the content and inform revisions to the instruments. The last two sections of the chapter provided a description of each of the instruments used in the study and details of the administration and analyses.

Chapter 4

Results

This chapter begins with an examination of the test characteristics of the various instruments used for the collection of data (See Appendix C, D, and F). This includes an item analysis, as well as a discussion of reliability and validity. The second section will report the results of the study in terms of the research questions posed in Chapter 2. The final section will explore the relationship between the instruments in terms of the five objectives presented in Chapter 3.

Test Characteristics

Item Analysis

Within the process of test development, a statistical analysis of individual items on a test provides information about the effectiveness of each item (Brown & Hudson, 2002). This helps to identify items that should be deleted, revised or retained on future versions of the test. This information can also be used to examine how a set of items functions for a particular group of students. The item analysis is included here to provide insight into the quality of items on the measures used in this study.

Classical test theory provides two statistics for item analysis: the item facility (IF), which is the proportion of examinees who correctly answered the item and the item discrimination (ID), the degree to which an item separates the 'upper' from the 'lower' group of examinees (Brown & Hudson, 2002). In this case, the ID is calculated by first computing the IF for the top 26% of the examinees and the IF for the bottom 26% and then subtracting the IF of the lower group from the IF of the upper group. These indices are typically used for norm-referenced tests but may also be used for a criterion-referenced test with a somewhat different interpretation. While statistics have been developed specifically for use with criterion referenced test items, they depend on the use of cut-scores that serve as the basis of decisions for passing/failing or mastery/non-mastery, for example establishing 65% as the passing grade. Since the instruments in this study are being designed for diagnostic purposes, no mastery level or standards for passing/failing have been set and therefore these statistics are not applicable.

There are two things to keep in mind when deciding if an item is 'good' or 'bad'. First, the indices are most useful when they are interpreted together. An item may have a low IF which would suggest that it is too difficult, confusing, or perhaps measuring something different, but if that item also has a high ID, it may be that it represents a more advanced skill that the stronger students have and the weaker ones do not. Second, although these instruments do not include a cut-score or a mastery level, they are criterion-referenced in that each student is being evaluated relative to the objectives not to other students. Thus, an item that appears 'weak' may in fact be an accurate reflection of the student's abilities. For example, if most examinees have mastered an objective, most will answer a corresponding item correctly and this will result in high IF and low ID. It is important therefore to consider a 'weak' item in more depth before deciding whether it should be replaced or revised.

Performance Test Item Analysis

Table H.1 in Appendix H shows the results of the item analysis for the practical test. An IF of .50 means that half of the examinees answered correctly and half incorrectly and those items around this item facility value are considered most useful in separating out the stronger from the weaker students. Brown and Hudson (2002) suggest that an item facility range of .40 to .70 would generally be considered 'good'. Using this convention, we can see there are a number of items that fall outside of this range, particularly on the low end. ID indices can range from –1.00 (all of the lower group got the item correct and all of the upper group got the item incorrect) to +1.00 (all of the upper group got the item correct and all of the lower group got the item incorrect). Items with IDs closer to 1.00 are discriminating between the stronger and the weaker students, and according to Brown and Hudson (2000), IDs of .40 and above are considered effective. There are several items on the performance test with IDs of 1.00. All ID indices for the performance test are positive and all but one are above .40.

As was mentioned earlier, considering the IF and the ID together helps in understanding how an item is functioning. For example, item 24 has a fairly low IF of .28 and a high ID of .90. A look at the test reveals that this item refers to copying information from one document to another, one of the more advanced skills covered by the objectives. The low IF makes sense and the high ID assures us that indeed the item is effective at separating the strongest from the weakest students. On the other hand, item 2 has a low IF of .30 and also a low ID of .40. This means that only 30% of the examinees were able to accomplish this task, but who was and was not successful is not strongly related to their overall score. This suggests that this item is only marginally doing what we want it to do. A look at the test reveals that this item asks the examinee to click the mouse. A very basic skill, it is surprising that only 30%

got it right. Clearly this item needs to be revised or replaced. With only a few such exceptions, the analysis suggests that items on the performance test are performing well.

Written Test of Knowledge Item Analysis

The IF values suggest that students had difficulty with a number of items on the written test (See Table H.2 in Appendix H). Only four items were answered correctly by 70% of the examinees and 14 items were answered correctly by fewer than 40%. The ID values suggest that a number of these items were also ineffective at separating the strongest from the weakest examinees and most of these are items for objective three. Items 1a1, 1a9, 1a2, 1a4, 1b5 and 2c10 all have very low IF and low ID values suggesting that they are not functioning as we would like. Since most of these items are from Part 1 of the test, in fact from section A of Part 1, it may be that there is a problem with the way this section is presented.

To determine if there was a difference in how the two sub-tests were functioning, scores on Part 1 and Part 2 were analyzed separately. In general the ID values for items on Part 2 were higher than for Part 1 with all but 2 being .67 or higher. In contrast only 8 items in Part 1 had an ID of .6 or higher with 5 items having an ID of less than .20. The range of results on the item analyses for the written test suggest that there are some weaknesses that should be addressed if it were to be used again, particularly in Part 1.

Computer Skills Self-assessment Questionnaire Item Analysis

Interpretation of the indices for the self-assessment questionnaire (See Table H.3 in Appendix H) are slightly unusual in that they do not reflect correct vs. incorrect answers. Instead, they reflect the proportion of students who answered positively. For example, the IF for item 19 is .65. This means that 65% of the respondents indicated that they could erase information from a document and 35% indicated that they could not. The ID for this item is 1.00, which means that all of the students who scored in the top 26% responded positively and all of those in the lower 26% responded negatively. This item appears to be very effective at separating the strongest students from the weakest ones.

Overall, the indices reflect a high degree of effectiveness and suggest that most items on the self-assessment questionnaire are effective in separating those who have higher computer literacy skills from those with weaker skill levels. There are a few items that warrant closer attention. Particularly three items, items 1, 2 and 3, all relating to objective 4, look suspect. These were answered positively by over 90% of the respondents and they showed a very weak relationship to the outcome. A look at the items is enlightening. It is not surprising that most people answered positively given that these items were specifically included to ensure that everyone would have a chance to answer positively to something. They are the most basic skills of moving the pointer, clicking and dragging. It is reasonable to expect that students would master objective 4 before mastering the others. Items 4,5, 8,9 and 15, with similar but less dramatic IF and ID values, are all similarly very basic skills.

Reliability

No test will get exactly the same results every time it is administered to the same student. Many factors play into how a student scores on a test besides what that student may or may not know (Brown & Hudson, 2002). How rested or nervous they are, for example, or how noisy or distracting the physical environment is, can all influence how well a student performs. Thus while some variance is due to changes in ability, some of it is caused by error. Reliability statistics allow us to account for variance and to understand how much consistency there is within a set of test scores.

When there is only one administration of a test, reliability is usually considered in terms of internal consistency. Internal consistency measures consider how different parts or items on a test relate to other parts or items on the same test. In particular they consider whether the different parts or items rank the same examinee in the same way (Brown & Hudson, 2002). A commonly used approach to establishing reliability on a single test is Cronbach's alpha, which compares all items to each other. Table 4.4 shows the alpha coefficients for the Performance Test, the Written Test of Knowledge, the Vocabulary Self-assessment and Computer Skills Self-assessment Questionnaires, and the Computer Experience Questionnaire. Two items were removed from the Computer Experience questionnaire that reduced its reliability. The alpha coefficients for all five measures are high. This suggests the items on each instrument are consistent in the way they rank an examinee and we can feel relatively confident that the items on the instruments are all measuring the same thing.

Table 4.1 Cronbach's reliability coefficient for each instrument

Instrument	N	k	alpha
Performance Test	40	30	.9786
Written Test of Knowledge	46	40	.9401
Vocabulary Self-assessment	46	20	.9423
Computer Skills Self-assessment	46	26	.9710
Computer Experience Questionnaire	46	10	.9175

Validity

Reliability coefficients tell us whether a test is consistently measuring the same thing but how do we know whether the test is measuring the construct we think it is measuring? This relates to test validity (Brown & Hudson, 2002). There are different kinds of validity and the best support for the validity of any test is to provide evidence from a variety of sources. Content validity and concurrent validity will be discussed here.

Content validity "involves demonstrating that the content of a test is related to the content of a well-described course... or domain..." (Brown & Hudson, 2002, p.213). Recall from Chapter 3 that the content of the three objectives-referenced tests used in this study was closely tied to a detailed task analysis carried out on a representative CALL lesson designed for the targeted group of students. Specific computer literacy performance objectives were identified based on the task analysis and the items for all three measures were created to address each of the objectives. A breakdown of the items on each test according to the objectives (See Appendix H) shows that while none of the instruments address each and every sub-objective, the items on all the instruments correspond closely to the five identified performance objectives.

Another source of content validity is the input of expert judges. While this study did not involve collecting feedback on the specific objectives by expert judges, the list of objectives can be compared to lists of computer skills generated by other experts. For example, Murphy, Coover and Owen (1989) performed a factor analysis on the items in their Computer Self-efficacy Scale (CSE) and found a three-factor solution, which they labeled: basic computing skills, advanced computing skills and mainframe computer skills. In their study of the psychometric properties of the same instrument, Harrison and Rainer (1992) identified the same factors. Table 4.2 shows the list of the basic computing skills on the left and sub-objectives for this study that correspond to them, on the right. Some of the basic computing skills are general and encompass a number of more specific items, such as using the computer to write a letter or essay. Considering that the Web did not exist in 1989, it is no surprise that it was not included in the CSE. However, it is somewhat surprising that there are a significant number of similar items on lists that were generated 14 years apart. A closer look suggests that while the concept remains, the actual process may have changed. For example, moving the cursor around the monitor screen was likely controlled by keystrokes in 1989 as opposed to the ability to control the mouse.

Table 4.2 Beginning level computer skills compared to Computer Literacy Objectives

Murphy, Coover and Owen	Meckelborg
Adding and deleting information from a data file	Edit text, Delete text Start and Quit Programs
Escaping/exiting from the program/software	
Copying an individual file	
Copying a disk	Select commands from the menu
Making selections from an onscreen menu	
Moving the cursor around the monitor screen	Mouse
Using a printer to make a 'hardcopy' of my work	Enter text, Apply formatting
Using the computer to write a letter or essay	
Handling a floppy disk correctly	Enter text, Save a document,
Entering and saving data (numbers or words) into a file	Save changes,
Storing software correctly	
Getting rid of files that are no longer needed.	
Working on a personal computer (microcomputer)	
Getting the software up and running	Start and Quit Programs
Calling-up a data file to view on the monitor screen	Opening files and folders
Organizing and managing files	

Concurrent validity involves the correlation of the results on one measure to other sources and measures. Evidence of concurrent validity is provided by the correlations between the scores on the various measures. These are described in detail in the next section.

Data Analysis

Descriptive Statistics

Table 4.3 presents the descriptive statistics for the five instruments used in the study. There is a wide range of scores on all measures. The mean for the Performance Test was 56.3 out of 90 or 63% suggesting that students do not have a mastery of the basic skills assessed. The Computer Skills Self-assessment scores were only slightly higher than those on the Performance Test with a mean of 17.3 out of 26 or 67% positive responses. On the other hand, the scores on the Written Test of Knowledge were noticeably lower, with a mean of 18.2 out of 40 or 46%. The lowest group mean was for the Vocabulary Self-assessment with 8.3 out of 20 or 42% positive responses. Scores on the Computer Experience Questionnaire fell between the other measures with a mean of 5.67 out of 10 or 57%.

Table 4.3 Descriptive statistics for all measures

	Performance Test	Written Test of Knowledge	Vocabulary Self-assessment	Computer Skills Self-assessment	Experience Questionnaire
N	40	46	46	46	46
k	30	40	20	26	10
Range	89	34	20	24	10
Minimum	1	0	0	2	0
Maximum	90	34	20	26	10
Mean	56.3	16.7	8.3	17.3	5.6
SD	27.67	9.59	6.56	8.96	3.56

Each section of the written test was also scored individually out of 20. Scores for Part 1 ranged from 0 to 17 with a mean of 8.8 or 44%. Scores on Part 2 ranged from 0 to 20 with a mean of 9.41 or 47%. While both sections appeared to be challenging, students did somewhat better on the vocabulary than on the skill items. This difference was not significant according to a paired-sample t-test (df=45, p=.283).

Looking at individual items on the Computer Experience Questionnaire revealed more specific information about the students' experience with computers. About two thirds of the students in the study (65%) have a computer at home and over half (59%) use it more than once a week. Only 7% reported having a computer at home that was not connected to the Internet. Besides use at home or school, 59% of the students reported using a computer regularly some place else. Email accounts were held by 63% of the students with most using it more than once a week. While 74% reported using a computer before coming to Canada, only 50% had used it more than once a week. In terms of studying computers, 37% reported having taken a course in using the computer, but only 7% reported taking a computer class in English. While 33% reported having taken a course in programming, only 2% took such a class in English.

The Research Questions

The research questions were addressed by using correlations. The Pearson correlation coefficient is used to show the degree of relationship between two sets of scores. Hatch and Lazaraton (1991) identify four basic assumptions that must be met before using the Pearson's correlation: the data must be continuous, the scores must be independent, the data must be normally distributed, and the relationship between the variables must be linear. In this case all the scores are continuous and are independent. Evans (1998) points out that when the sample is larger than about 30, the sampling distribution of the correlation coefficient tends to be normal regardless of population shape, so this assumption is also met. Scatterplots for all measures were generated confirming that a linear relationship existed for all measures. Running Pearson correlations therefore was deemed the appropriate correlational procedure.

1. What is the relationship between a performance assessment of computer literacy and a written test of knowledge among adult ESL learners?

As seen in Table 4.4, the Pearson correlation coefficient for the Performance Test and the Written Test of Knowledge is $r = .859$. This means that there is a strong significant relationship between the two measures with 74% overlap between what the two instruments are measuring.

Table 4.4 Pearson correlation among instruments

	Perf.	Know.	Voc. S-A	Skill S-A	Exp.
Perf.	1				
Know.	.859*	1			
Voc S-A	.656*	.731*	1		
Skill S-A	.891*	.798*	.679*	1	
Exp.	.829*	.708*	.598*	.908*	1

* Correlation is significant at the .01 level (1-tailed)
Note: Perf.=Performance Test. Know.=Written Test of Knowledge. Voc. S-A=Vocabulary self-assessment. Skill S-A= Computer Skills Self-assessment. Exp.= Computer Experience Questionnaire

2. What is the relationship between a performance assessment of computer literacy and a self-report among adult ESL learners?

Table 4.4 shows that the scores on the Computer Skills Self-assessment Questionnaire correlated more strongly with those of the Performance Test than any of the other measures. A correlation of $r = .890$ suggests that there is a 79% overlap between the two measures.

The Vocabulary Self-assessment Questionnaire had the weakest correlation with the Performance Test (r=.656). The moderate correlation suggests there is a relationship, but not as strongly as the written vocabulary scores do. To examine the relationship between the self-report measure and the written measure of vocabulary, the Vocabulary Self-assessment scores were correlated to the Written Test of Knowledge total scores and to the scores on each part. Results show a moderate correlation between the two instruments (r=.731) , slightly stronger for the vocabulary section Part 2 (r=.720) than for the skills section Part 1 (r=.648).

3.How does Computer Experience relate to measures of performance, knowledge and self-report among adult ESL learners?

Table 4.4 shows that the scores on the Computer Experience Questionnaire correlated significantly with all the other measures, most strongly with the Computer Skills Self-assessment Questionnaire (r=.908) and the Performance Test (r=.829). This suggests that there is indeed a relationship between computer experience and computer literacy.

Each item on the Computer Experience Questionnaire was also correlated individually to the other scores. For this correlation the Spearman's correlation was used since the items were yes/no questions. Table 4.8 shows that all but one of the items correlated significantly with the results on the other measures. The items that had the strongest relationship to all other measures were the items relating to having an email account and using email more than once a week. Having a computer at home showed a weaker correlation to the other scores than using a computer at home more than once a week. Obviously some students had a computer at home but did not use it very often.

Table 4.5 Spearmans's Rho correlations for experience to other measures

Experience Item	Performance Test	Written Test of Knowledge	Computer Skills Self-assessment
Computer at home	.645*	.453*	.654*
Internet connection	.665*	.484*	.638*
Use home computer more than once/week	.741*	.549*	.756*
Other access	.444*	.361*	.456*
E-mail account	.769*	.669*	.748*
Use e-mail more than once/week	.806*	.738*	.813*
Used computer before coming to Canada	.577*	.555*	.650*
Used computer more than once/week	.661*	.682*	.635*
Computer course	.340	.262	.421*
Programming course	.426*	.432*	.490*

* Correlation is significant at the 0.01 level (1-tailed)

Scoring by Objective

Total scores allow us to evaluate how the instruments are working overall and to gain insight into the relationships among them. The fact that there is a strong correlation between the instruments suggests that any of the measures would be appropriate for use in the classroom. However, because the assessment was designed around performance objectives, an analysis in terms of the content across the three objectives-referenced measures was needed to explore how well each measure performs on the objectives. Therefore, test performances were also examined with respect to the five objectives, abbreviated here for simplicity as Word Processing, Web, Windows, Mouse and Typing.

A score for each of the objectives was calculated for the Performance Test, the Written Test of Knowledge, and the Computer Skills Self-assessment. This was done through a number of steps. First each sub-objective was assigned an equal value of 1 point. Items were organized by the sub-objectives they referred to and the mean was calculated for any sub-objective that was addressed by multiple items. The scores on the sub-objectives for an objective were then added together to produce a proportion score. However, since not all objectives have the same number of sub-objectives, a conversion of each objective score was done to a produce a proportion score out of 4. Scores for all five objectives were then added for a possible total score of 20.

Figure 4.1 shows the mean scores out of 4 for each objective on each of the three instruments. The scores on the Performance Test are the most similar across the five objectives. Since the objectives are basic skills and are likely to be closely related, this reflects the greater degree of authenticity and directness of the measure. It is also clear that in general, scores for the objectives were lower on the Written Test of Knowledge than on the other measures. This may reflect a confounding with language proficiency since there was a greater demand for language use. As well, the item analysis suggested that a number of items on the Written Test of Knowledge needed to be revisited and the lower scores might be a reflection of this as well. This will be discussed in greater depth in Chapter 5.

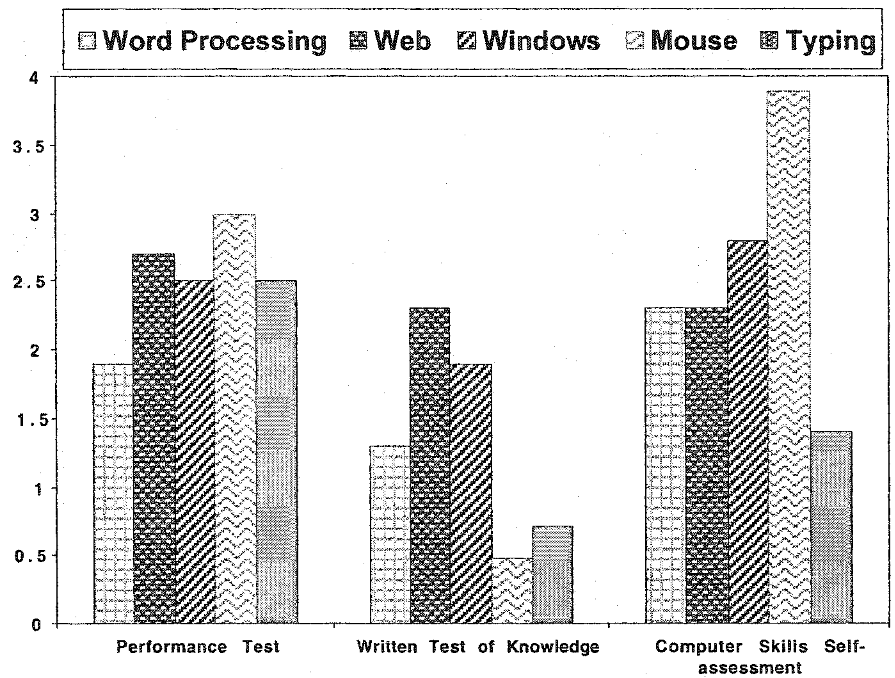

Figure 4.1 Scores by objective across measures

The scores for the mouse objective have the greatest degree of variability across the measures. The items on the Written Test of Knowledge relating to this objective asked students to match a vocabulary item such as click, point, etc. to a written definition. There was a greater degree of language competency required that might have had a confounding influence resulting in the low scores. The high scores reported on the Computer Skills Self-assessment Questionnaire, on the other hand, were the easy items that had been intentionally included to ensure that everyone would be able to answer positively to something. These items were identified in the item analysis as weak items and the results of that weakness are evident here.

Scores for the typing objective were substantially lower on both the Written Test of Knowledge and the Computer Skills Self-assessment Questionnaire, especially on the written. Again items for this objective on the test were limited to vocabulary items this time requiring students to label a keyboard. While not demanding the same language proficiency as the mouse related items, it is totally possible for students to be able to use the keyboard without being able to label the keys. There was only one item relating to the typing objective on the Computer Skills Self-assessment, and it asked about a fairly high level of skill, being able to type without looking at your fingers. It is not surprising that only a few students responded positively. The fact that the mean is low suggests that students were indeed reading and answering the questions on the self-report carefully.

This chapter provided an examination of the characteristics of the assessment instruments used and presented the results of the study. The item analysis demonstrated that in general the items on the instruments are performing well. A high degree of reliability was established and evidence of validity was provided. The results revealed a strong correlation between the Performance Test and the Written Test of Knowledge, the Computer Experience Self-assessment Questionnaire and the

Computer Experience Questionnaire. A moderate correlation was found between the Performance Test and the Vocabulary Self-assessment. Mean scores for each objective on the three objective-referenced instruments (Figure 4.1) revealed that scores for objectives on the Performance Test were more similar than on the other two measures and that the scores on the Written Test of Knowledge were significantly lower than the Computer Skills Self-assessment or the Performance Test.

Chapter 5

Discussion

This chapter will begin with a brief summary of the results of the study. Issues relating to the assessment of computer literacy and to the use of the instruments developed in this study will then be discussed. In particular, the theoretical distinction between declarative and procedural knowledge and issues relating to self-assessment measures are considered. This is followed by a look at classroom applications and a return to the instructional design model presented in Chapter 1. The chapter concludes with an examination of the limitations of the study and recommendations for future work.

Summary of Results

The most direct and authentic way to measure a skill is through observation of the application of that skill (Priestly, 1982). This is not always logistically feasible in a classroom setting. The purpose of this study was to explore the possibility of using four measures, a computer experience questionnaire, a vocabulary self-assessment questionnaire, a computer skills self-assessment questionnaire and a written test of knowledge, as alternatives to a performance measure. The focus was on computer literacy defined as the machine level skills required by adult ESL students to use the computer for language learning activities. The machine-level skills were identified through a task analysis of selected computer-related language learning activities and transformed into performance objectives. These were then used as the basis for the self-assessments, the written test, and the performance test, which served as the predictor variable in the correlations.

The main findings from the data analyses are as follows:

1. There was a high degree of reliability for all measures.
2. There was a strong significant correlation between the Written Test of Knowledge and the Performance Test and between the Computer Skill Self-assessment Questionnaire and the Performance Test.
3. There was moderate significant correlation between the Vocabulary Self-assessment and the Performance Test.
4. There was a strong significant correlation between Computer Experience and the measures of computer literacy.

The correlations reported in this study were very strong despite a relatively small sample size. In part, this reflects the heterogeneous nature of the group. There is typically a wide range of skills and abilities represented in an adult education class and this is true for computer literacy skills as well. Another factor that contributed to the strong correlations among the instruments is the systematic procedure applied to the development of the content of all of the instruments. One of the strengths of instructional design is that it provides the framework for such systematization.

Theoretical Issues

Declarative vs. Procedural Knowledge

To understand the differences between the measures, we need to consider the nature of the knowledge that underlies them. An influential theoretical distinction proposed by Anderson (1983, 2000) distinguishes between declarative and procedural knowledge. According to Anderson, declarative knowledge is what you know *about* a topic, factual knowledge that is readily available to consciousness. Procedural knowledge, on the other hand, refers to knowing how to do something and is automatic and unconscious. Initially, performance proceeds on the basis of declarative knowledge and is generally slow and effortful. Once a skill is proceduralized, it becomes rapid and relatively effortless.

A written test of a skill typically measures declarative knowledge. This would suggest that students who are developing their expertise in an area should do better on a written test than on a practical one. However, results from the Written Test of Knowledge and the Performance Test do not reflect this. Students did significantly better on the performance measure than they did on the written test suggesting that their procedural knowledge is greater than their declarative knowledge. There are three possible factors that might account for these results.

First, the scoring procedure for the Performance Test was process-oriented and employed an observational method. This meant that students scored points for being able to complete partial tasks resulting in higher scores. The knowledge being assessed was not necessarily fully automatized and students were able to score points even if they were still working with declarative knowledge. In contrast, in one of the few studies in the educational literature to include a performance measure (Davies, 2002), the scoring was product-oriented and did not involve observational methods. That is, learners were judged on the quality of the files they submitted at the end of the performance test, not on the process they went through to accomplish the task. Results in her study confirmed that declarative knowledge developed prior to procedural knowledge as students did better on the written test than on the performance measure. Similarly, in my pilot study students scored better on the written test than on the performance measure, which also used product-based scoring.

A second possible factor contributing to the weaker declarative skills on the Written Test of Knowledge is the mis-match between the way in which the skills were developed and the testing instrument. Written tests are often seen as more 'objective' measures because there is usually a clear correct and incorrect answer. They are however, indirect measures of skilled performance. Since it is most likely that students had learned their computer skills through actual use of the computer rather than through written text, the written task may have underestimated their knowledge.

Finally, the unexpected difference between the written and performance scores could also reflect a confounding with English language competency on the written test as suggested in Chapter 2. The Written Test of Knowledge demanded more linguistic ability than the Performance Test where the researcher was available for explanations, or the Computer Skills Self-assessment Questionnaire which consisted of simple sentences supported by visuals. It was difficult to keep the written test as linguistically simple or to support every item with visuals. For example, the definition for click included at least three potential language issues (italicized in the sentence): "*Press* the *mouse button* once and then *let go of* it." Language competency therefore, may have influenced how well a student did.

In addition to overall language proficiency, it is also possible that simply not knowing the vocabulary might be interfering with students' results on all measures.

Although visuals and plain language were used as much as possible, there were times when computer terminology was needed. To see if there was a significant relationship between vocabulary and computer literacy, the two sections of the written test were analyzed separately. The two parts of the test itself were significantly correlated (r=.773 significant at .01). This confirms the idea that language is a factor for the written test since Part 2, which is specifically about vocabulary correlates with Part 1, which is purportedly about skills. When correlated to the performance scores, Part 1 correlated at .823, and Part 2 at .809, both significant at .01. Language proficiency is clearly also related to performance.

Issues with Self-assessment

The self-report questionnaire has been a very popular method of measuring computer literacy (Davies, 2002; Jones & Pearson, 1996; Murphy et al., 1989; Turner et al., 2000). Measures have ranged from simple questionnaires with yes/no items like those used in this study, to scales of attitudes and self-efficacy. There are concerns however, that reliability of self-report measures is affected by what is called response effects, that is, "tendencies for certain people to respond to factors other than question content" (Heilenman, 1990, pg. 175). Some of these factors include acquiescence, social desirability, and question wording effects.

Acquiescence is the tendency to agree or to respond positively to an item regardless of the content. Research suggests for example that it is easier to agree with a positively worded statement than to disagree with a negative one (Heilenman, 1990). Social desirability, the need for approval and respect from others, can either consciously or unconsciously cause respondents to overestimate positive and underestimate negative characteristics (Heilenman, 1990). There are also other possible causes of over and underestimating. Evidence suggests that there is a tendency among stronger learners to underestimate what they can do and weaker learners to overestimate (Blanche & Merino, 1989; Heilenman, 1990). The selection and wording of items on a self-assessment question can also influence how accurately a person can assess their own performance. Items that closely relate to students' situations and are specific rather than vague or general have been found to be more highly correlated to performance (LeBlanc & Painchaud, 1985).

The impact of these response effects is borne out by two of the previous studies that used a self-report instrument and explored its relationship to more objective measures of computer literacy. Davies (2002) correlated the results of the self-report measure to knowledge and performance scores. Turner, Sweany and Husman (2000) correlated a self-report measure to a written test. Despite strong reliability coefficients, these studies reported low to modest correlations with performance and knowledge. The information provided regarding the instruments shows that both of these self-report instruments used negatively worded items and more general items. This might have contributed to correlations being lower than those found in this study.

Another factor that may interfere with the accuracy of a self-report measure is the fact that not all people are equally good at self-assessment. The ability to reflect on oneself is identified by Gardner (1983) as 'intrapersonal intelligence', one of the multiple intelligences. Since not all people will have this ability to the same degree, there will be individual differences in the accuracy of their self-assessments.

Despite these concerns with the reliability of self-reports, the results on the Computer Skills Self-assessment Questionnaire were highly correlated to the scores on the performance test ($r = .891$). The strength of this correlation may reflect the fact that the questionnaire consisted of very simple, specific and concrete items all of which were stated positively. While weaker students especially may have felt some social pressure to be able to respond positively, knowing that they would also be doing a written test and a computer-based activity with the researcher, it is unlikely that they would have consciously overestimated their abilities. The internal reliability of the self-assessment (.97) lends further support to the reliability of the instrument.

Practical Applications

How practical is the assessment instrument?

When deciding how to collect information for evaluation purposes, Genesee and Upshur (1996) emphasize that the quality of the information gathered will depend on the reliability and validity of the instruments. Once reliability and validity are established, however, practicality often dictates the final choice. They identify five aspects of practicality:

- Cost: is it affordable?
- Administrative time: is the required time available?
- Compilation time: is there enough time to score and interpret results?
- Administrator qualifications: is the teacher qualified?
- Acceptability: is it acceptable to the students, teachers and community?

Table 5.1 presents an overview of the strengths and weaknesses of the five measures in terms of these aspects of practicality.

Table 5.1 Strengths and weaknesses of measures in terms of practicality

	Cost	Administration	Compilation	Qualifications	Acceptability
Performance Test	Moderate	High	Moderate	High	High
Written Test of Knowledge	Low	Moderate	Low	Low	High
Vocabulary Self-assessment	Low	Low	Low	Low	Low
Computer Skills Self-assessment	Low	Low	Low	Low	Low
Computer Experience	Low	Low	Low	Low	Moderate

The financial costs of using the performance test are tied to the amount of time needed for development and to the resources required for implementation. Issues of standardization are critical to the reliability of an observation scheme and development requires substantial investment of time to establish the procedures and to ensure the quality of the checklist. The primary cost in terms of resources is access to a separate space with a computer. Administrative time is quite high as the teacher must be free to spend 5 to 20 minutes with each student. The compilation of scores involves a number of steps and calculations, which will take time either in terms of entering the scores into the computer for the computer to complete the calculations or to do the calculations by hand. The teacher needs to have training in order to administer the test in a standardized way and to be consistent in filling in the checklist. A performance measure is likely to have a high degree of acceptability for both students and teachers.

The Written Test of Knowledge requires little in the way of financial support past the photocopying of the test. Despite the fact that it can be administered to the whole group at the same time and thus is not as time consuming as the Performance Test, it does require more time than the other written measures, taking students between 30 to 40 minutes. Scoring is familiar and straightforward requiring only the addition of the number of correct responses. For scores by objective some additional simple calculations would be required. No special qualifications are needed to administer or score the test. Because written tests are so common in the classroom, the Written Test of Knowledge is likely to have a fairly high degree of acceptability to the students and the teacher.

The costs of administering the two self-report measures are fairly low, requiring only photocopying. The time required is minimal, from 10 to 15 minutes for the Computer Skills Self-assessment and less than five minutes for the Vocabulary Self-assessment. Scoring, similar to the written test, is familiar and straightforward but requires additional simple calculations for scoring by objective. No special training is needed for the teacher to administer or score the questionnaires. It is likely that the self-report will have a lower degree of acceptability because of the problems associated with reliability of self-reports. This may be compensated for by the recognition within adult education of the benefits of involving adults in their learning process.

Finally, the Computer Experience Questionnaire would incur little cost as it is only one page long. It takes only minutes to complete, and scoring involves a straight summing of items marked with a 'yes'. There are no special qualifications required to administer it. The wide use of experience measures suggests that the Computer Experience Questionnaire would be viewed as quite acceptable by those involved.

The teacher will have to consider the pros and cons of each instrument keeping in mind the very first question we asked in beginning the evaluation process: "What is the purpose of evaluation?" The circumstances envisioned for this study, that is the need for a diagnostic tool to guide the teacher's planning and instruction, is a fairly low-stakes circumstance, and given the limited amount of time in the classroom, it is likely that one of the less time-consuming measures would be more appropriate.

How informative is the assessment instrument?

An additional consideration in choosing an assessment instrument is the usefulness of the information that it provides. As was discussed in Chapter 1, evaluation instruments can serve two purposes in the design process: summative or formative. If the instrument is to be used for summative purposes, a simple score will provide the necessary information to determine if the student has mastered the skills in question. Formative assessments, however, especially those used for diagnostic purposes, require more detailed feedback. The usefulness of the information that is gleaned from the instrument will thus also need to be considered in selecting the best alternative.

The Computer Experience Questionnaire is a quick and easy way to get a general idea of the students' computer literacy levels. It provides two kinds of feedback, a total score and information on each item.

Two previous studies also created a score for experience. Eignor, Taylor, Kirsch and Jamieson (1998) summed the responses on the 11 items of their questionnaire to create a composite computer familiarity score. This score was used to place the students into a category of low, moderate or high computer familiarity. Dologite (1987) created a computer literacy index ranging from 0 to 90 by assigning values to each variable on the Student Information Sheet. For example, three points were assigned for each software package a student used. Students' placement on the index was used to identify the readiness of the students for enriched computer classes. Similarly, the total scores on the Computer Experience Questionnaire can provide a prediction of students' levels of computer literacy in relation to the others in the class or of their readiness to embark on computer-assisted language learning activities.

A larger number of previous studies considered individual items of experience and how they correlated to other measures of computer literacy. For example, Davies (2002) found low correlations between scores on a performance test and a number of computer experience factors such as having a computer at home and access to other computers. The strongest correlation she found was for the variety of applications used (.542). A similar analysis of the results for this study showed moderate significant correlations between all but one item on the Computer

Experience Questionnaire and the Performance Test scores (See Table 4.5). One might argue based on this information, that using only one or two questions would be sufficient to predict computer literacy levels. However, it is possible that a student might not have experience in one area but still have a high score overall. If just that one area were used, results would not accurately reflect that student's situation. For this reason, calculating a score for a number of computer experience related items is likely to provide a more reliable prediction. While the Computer Experience Questionnaire had the weakest correlation to the Performance Test of all the measures used in this study, it was still a strong predictor and correlated to the performance measure more strongly than any single item did.

Total scores on the Performance Test, the Written Test of Knowledge, the Computer Skills Self-assessment and the Vocabulary Self-assessment can also provide the teacher with a general picture of the levels of computer literacy in the class. Those who score higher are likely to be more competent on the computer. These scores and the score for Experience provide information that can be used in a general way. However, they do not help the teacher to identify where instruction might be needed. More useful as a source of information about what skills the students have mastered and what instruction will be required, are those measures that are based on performance objectives. By providing a score for each objective, the teacher will be able to identify how a student, or class, is performing on any specific sub-skill and may be able to adjust their plans accordingly.

Of the three objectives-referenced instruments, the analysis of practicality suggests that the Performance Test is the least practical. Given the low-stakes involved in the use of the assessment for diagnostic purposes, either the Written Test of Knowledge or the Computer Skills Self-assessment would appear to be the most appropriate choices. Because the scores on the self-report were closer to the scores on the performance measure, it will be used here for the purpose of illustrating the use of this measure in instructional planning.

How can the results inform the design of instruction?

Table 5.2 shows the results from the Computer Skills Self-assessment for one of the classes in the study. The students have been ranked in order of their total score, from the highest to the lowest. Recall that each objective was scored out of 4 for a total of 20 points.

There appear to be three groups of students in this class. Four students report having strong computer literacy skills, while four others fall in the middle of the scale. The largest group, which contains just under half of the students, appears to have low computer literacy skills. Obviously the teacher of this class will need to pay considerable attention to computer literacy skills when planning CALL activities.

All objectives have low class means except for the objective relating to use of the mouse. We know that scores for this objective were over-reported and this is evident in the class report. Notice that students 27, 33 and 32 all have scored 4 for using the mouse, yet scores for all other objectives are effectively 0.

Table 5.2 Results on Computer Skills Self-assessment for Class 2

Student	WP	Web	Windows	Mouse	Typing	Total
24	4.0	4.0	4.0	4.0	4.0	20.0
31	4.0	4.0	4.0	4.0	4.0	20.0
21	3.7	4.0	4.0	4.0	4.0	19.7
25	3.6	4.0	3.7	4.0	4.0	19.3
23	4.0	3.0	4.0	4.0	0.0	15.0
22	4.0	1.0	2.9	4.0	0.0	11.9
28	1.1	3.0	1.4	4.0	0.0	9.5
30	2.1	0.0	3.4	4.0	0.0	9.5
29	1.3	0.0	0.9	4.0	0.0	6.2
27	0.0	0.0	1.1	4.0	0.0	5.1
33	0.0	0.0	0.3	4.0	0.0	4.3
32	0.0	0.0	0.0	4.0	0.0	4.0
20	0.0	0.0	0.9	2.7	0.0	3.5
26	0.0	0.0	0.0	2.7	0.0	2.7
Class Mean	2.0	1.6	2.2	3.8	1.1	9.4

Given this information, we now return to the instructional design model described in Chapter 1 to reflect on how it informs the instructional design process. A number of the design elements shown in Figure 1.1 have been addressed in this study. The need for instruction has been clearly demonstrated. A task analysis served as a vehicle with which to identify the prerequisite computer skills needed by adult ESL students. In order to assess which skills the students have mastered, instructional objectives, derived from the task analysis, served as the guide for the development of the evaluation instruments. The results of the formative evaluation suggest that at least for the majority of this class, some instruction on all of the objectives will be needed.

The four elements in the model shown in Figure 1.1 that address the design of instruction are content sequencing, instructional strategies, designing the message and instructional delivery. The objectives provide guidance regarding the sequence of instruction, as the mouse and typing skills are clearly required in order to perform the other objectives. Navigating the Windows' environment is also needed in order to use the Web or the word processor. Skills from this objective could be taught in conjunction with or prior to the other two objectives.

The results from the Computer Skills Self-assessment provide the teacher with information to guide the choice of instructional strategies. First in terms of individualization of the instruction, the results suggest that the students could easily be placed in small groups. For example weaker students could be paired with stronger students who could act as tutors helping the weaker students to develop their skills. This also offers the tutors the opportunity to practice language associated with the tutor rather than the tutee role. Alternatively, it may be appropriate to group the students according to ability, giving the stronger students an independent activity while the weaker ones work with the teacher to develop the missing computer skills.

Choosing an appropriate strategy must reflect the nature of the performance objectives. Since the objectives are skills or procedures, teaching with a written exercise is unlikely to be the most appropriate method. Technical vocabulary was shown to be an important element in computer literacy and should also be targeted for instruction.

Design of the instruction will require special attention to the language level of any material used. The use of visuals will be an important part of any instruction for this group of students.

Delivery methods refer to the manner in which the instruction is delivered to the student. Kemp et al. (1999) discuss the group presentation, self-paced and small groups as three possible methods. It is possible that the teacher might choose a presentation style since many students need instruction on the same objectives. However, it might also be appropriate to arrange for self-paced individual instruction for students to be able to address the objectives they need in tutorial modules. This might be done through the use of online tutorial programs or through development of multi-media software. It is clear how much easier the job of the teacher is with the information provided by the assessment rather than guessing what skills have or have not been mastered by the students.

Conclusion

Limitations

In this study, it was found that different indirect measures of computer literacy were effective as predictors of performance. However, this may not be true for all adult ESL students. It is important to remember that this was a relatively small sample of students in a particular socio-cultural context, with specific language and computer literacy backgrounds. Therefore, generalizations to all adult ESL classes cannot be made. Furthermore, the instruments are limited to the three areas of computer literacy listed in the objectives. While many of these skills may be transferable to other uses of the computer, they do not explicitly help teachers identify other specific areas of competence which might be of interest such as the use of email.

Recommendations for Future Research

Based on the results of the study, each of the measures would need to be revised before being used in the classroom. For example:

- Performance Test: A simpler scoring procedure would make the checklist easier to fill out.
- Written Test of Knowledge: The item analysis indicated that the first section had many weak items and needs to be revised. This instrument in particular may need to be evaluated in terms of language difficulty.
- Computer Skills Self-assessment Questionnaire: Items need to be added to round out the representation of typing and mouse skills.
- Vocabulary Self-assessment Questionnaire: Content could be revised to systematically reflect the objectives.
- Experience Questionnaire: The two items removed from the analysis for reliability issues need to be deleted from the questionnaire. Since the three frequency of use items were scored dichotomously in the end,

the wording of those items should be changed to yes/no questions, for example: Do you use your computer more than once a week?

The revised instruments would need to be subjected to a validation study to confirm that the instrument is in fact measuring the domain specified (Brown & Hudson, 2002). This could be done by first having a teacher rate his or her students' computer literacy skills based on classroom observation. Then, the assessment instrument could be administered and scores correlated. If there is a strong correlation, it would provide evidence for the construct validity of the instrument.

An obvious next step would be to move forward in the design process. This might include investigation of the instructional strategies that would work best with the learning objectives in this particular environment. Also issues of delivery method and of course development of the instructional material.

One of the difficulties encountered in the development of the instruments was the lack of information we have about the relationship between the component skills of computer literacy. Research into the stages and processes of the development of these skills is needed.

A related issue is the question of transferability of computer skills across applications. The results of the pilot revealed problems with the transfer from the Windows platform to the Mac OS. Is it easier to learn on a Mac OS, for example, which is known for its user-friendliness, and then move to a Windows platform or is it easier to learn Windows first and then transfer the skills to the Mac OS environment? How much transfer is at play when moving from one type of application to another? These are some of the issues that emerge from this study.

Final Remarks: Computer Literacy Revisited

As was discussed earlier in the review of the literature, the term computer literacy is used here in the limited sense of basic machine level skills. Just as the ability to know how to decode is needed before one can enjoy literature, the ability to manage machine-level skills is required before one can enjoy the opportunities offered by technology. While many researchers in the area of computer-assisted language learning have tended to overlook the impact of computer literacy skills on the use of computers in the classroom, this study shows that the lack of basic computer literacy is a real issue, at least for these adult ESL learners.

While the skills assessed here are certainly not exhaustive, they do provide a sampling of some of the skills essential for use of computers in the classroom. If students can use the mouse, choose commands from a menu, enter and save text, open files, etc. they will have the foundational skills necessary to use many other software programs as well. They will be able to follow instructions in order to learn to use new software programs and they will gain independence to develop their skills on their own.

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Appendix A

Computers in LINC - Questionnaire

Part 1: Tell me about your experience with computers. **Check the best answer.**

1. Do you use a computer at home?

□ Yes □ No

If No, go to question 5.

2. What kind of computer is it?

□ Mac □ Windows □ Other □ I don't know

3. Is it connected to the Internet?

□ Yes □ No

4. How often do you use it?

□ Everyday
□ 4-6 times a week
□ 1-3 times a week
□ 1-3 times a month
□ less than once a month

5. Other than at school, do you use another computer more than once a week? (For example, at someone else's house, the library, or at work)

□ Yes □ No

6. Do you have a personal email account?

□ Yes □ No

If No, go to question 8.

7. How often do you use email?

- ☐ Everyday
- ☐ 4-6 times a week
- ☐ 1-3 times a week
- ☐ 1-3 times a month
- ☐ less than once a month

8. Did you use a computer before studying at Open Door?

☐ Yes ☐ No

9. Have you ever taken a course about using the computer?

☐ Yes ☐ No

10. Have you ever taken a course about programming?

☐ Yes ☐ No

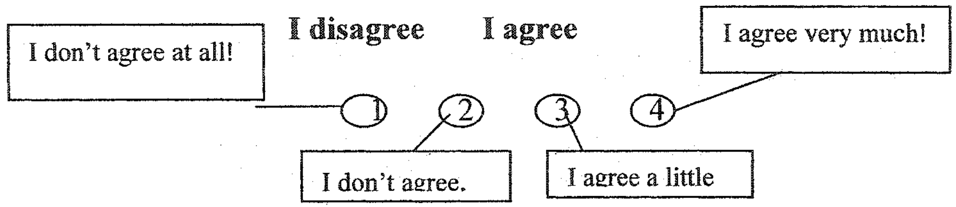
11. Please write a few words describing when and where you used a computer for the first time.

12. Check all of the following that you know you have used.

☐ None	☐ Netscape Navigator	☐ InternetExplorer
☐ Spell It	☐ MatchMaster	☐ Storyboard
☐ Grammar I & II	☐ AppleWorks	☐ Microsoft Works
☐ Microsoft Word	☐ WordPerfect	☐ Microsoft Outlook
☐ Eudora	☐ HyperStudio	☐ MSPowerPoint
☐ QuickTime Player	☐ Adobe Acrobat Reader	☐ Winzip
☐ Stuffit Expander		

Other:____________________________________

Part 2. Tell me what you think/feel about computers. **Circle the number that best describes how you feel about each sentence.**



Example: Saskatoon is beautiful. 1 2 3 (4)

	I don't agree			I agree
1. Computers can make it easier and faster to do things.	1	2	3	4
2. It is important for me to know how to use the computer.	1	2	3	4
3. Using the computer has nothing to do with my English skills.	1	2	3	4
4. Computers are causing many problems in society.	1	2	3	4
5. Doing things on the computer takes more time.	1	2	3	4
6. Using the computer can help me improve my English.	1	2	3	4
7. People who don't have computer skills can't find good jobs.	1	2	3	4
8. There is too much pressure to use a computer.	1	2	3	4
9. It is helpful to use computers in my ESL class.	1	2	3	4
10. Computer skills will help me find a good job.	1	2	3	4
11. Using computers in my ESL class is a poor use of time.	1	2	3	4
12. Solving problems that happen when I am using the computer is interesting to me.	1	2	3	4
13. I would like to learn more about the computer.	1	2	3	4
14. I wish I didn't have to use the computer.	1	2	3	4

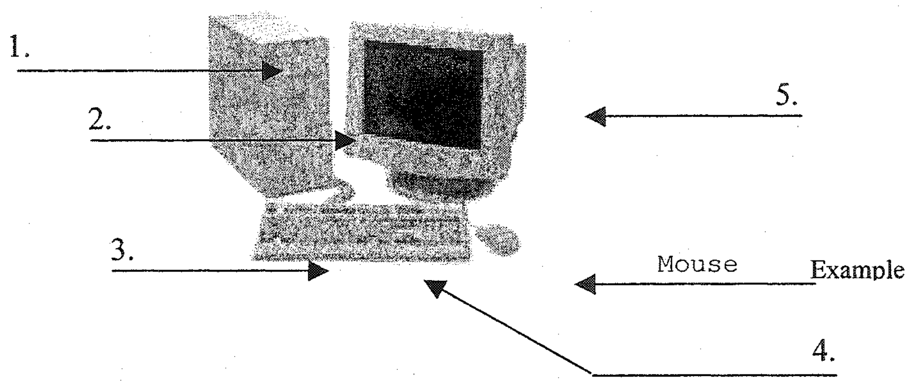
Part 3: Tell me how confident you feel using the computer. Circle the number that best describes how sure you are that you can do each of the following things on a computer.

	Not at all sure										Perfectly sure
1. Use the computer to write a letter or paragraph.	0	10	20	30	40	50	60	70	80	90	100%
2. Move the pointer (➶) on the screen.	0	10	20	30	40	50	60	70	80	90	100%
3. Choose something from a menu.	0	10	20	30	40	50	60	70	80	90	100%
4. Type words and numbers in a document.	0	10	20	30	40	50	60	70	80	90	100%
5. Save words and numbers in a document.	0	10	20	30	40	50	60	70	80	90	100%
6. Open a document so you can read it.	0	10	20	30	40	50	60	70	80	90	100%
7. Stop or close a program.	0	10	20	30	40	50	60	70	80	90	100%
8. Use a floppy disk or CD properly.	0	10	20	30	40	50	60	70	80	90	100%
9. Use a printer to print something.	0	10	20	30	40	50	60	70	80	90	100%
10. Understand words about the computer.	0	10	20	30	40	50	60	70	80	90	100%
11. Describe the parts of the computer and what they do.	0	10	20	30	40	50	60	70	80	90	100%
12. Learn to use new programs.	0	10	20	30	40	50	60	70	80	90	100%
13. Troubleshoot (find and solve) computer problems.	0	10	20	30	40	50	60	70	80	90	100%
14. Get help for problems.	0	10	20	30	40	50	60	70	80	90	100%
15. Copy or move information in a document.	0	10	20	30	40	50	60	70	80	90	100%
16. Copy a document or file.	0	10	20	30	40	50	60	70	80	90	100%
17. Get rid of (delete) a file when you don't need it anymore.	0	10	20	30	40	50	60	70	80	90	100%
18. Add or erase information in a document.	0	10	20	30	40	50	60	70	80	90	100%
19. Organize and manage files.	0	10	20	30	40	50	60	70	80	90	100%
20. Start programs.	0	10	20	30	40	50	60	70	80	90	100%

Computers in LINC - Knowledge/Concepts

A. Use the words to label the parts of the computer. Writing the correct word on each arrow in the picture below. An example is done for you.

Keyboard   Monitor   CPU   Mouse   Disk drive
Space bar



B. Match the word with the instructions by drawing a line. An example is done for you.

Click	Move the mouse so the pointer ( ) is on top of something.
Double-click	Use the arrows on the side of the window to move the page up or down.
Drag	Quickly press the mouse button and let go of it two times.
Point	Press the mouse button when the pointer is on something, hold the button down while you move the pointer to another place. Then, let go of the mouse button.
Press	Press the mouse button once and then let go of it.
Scroll	Push down. For example: push down the return key.

C. Look at the following picture. Which arrow is pointing to the place where you need to go to do the following. An arrow can only be used once.

Example: ____F__ Close the window.

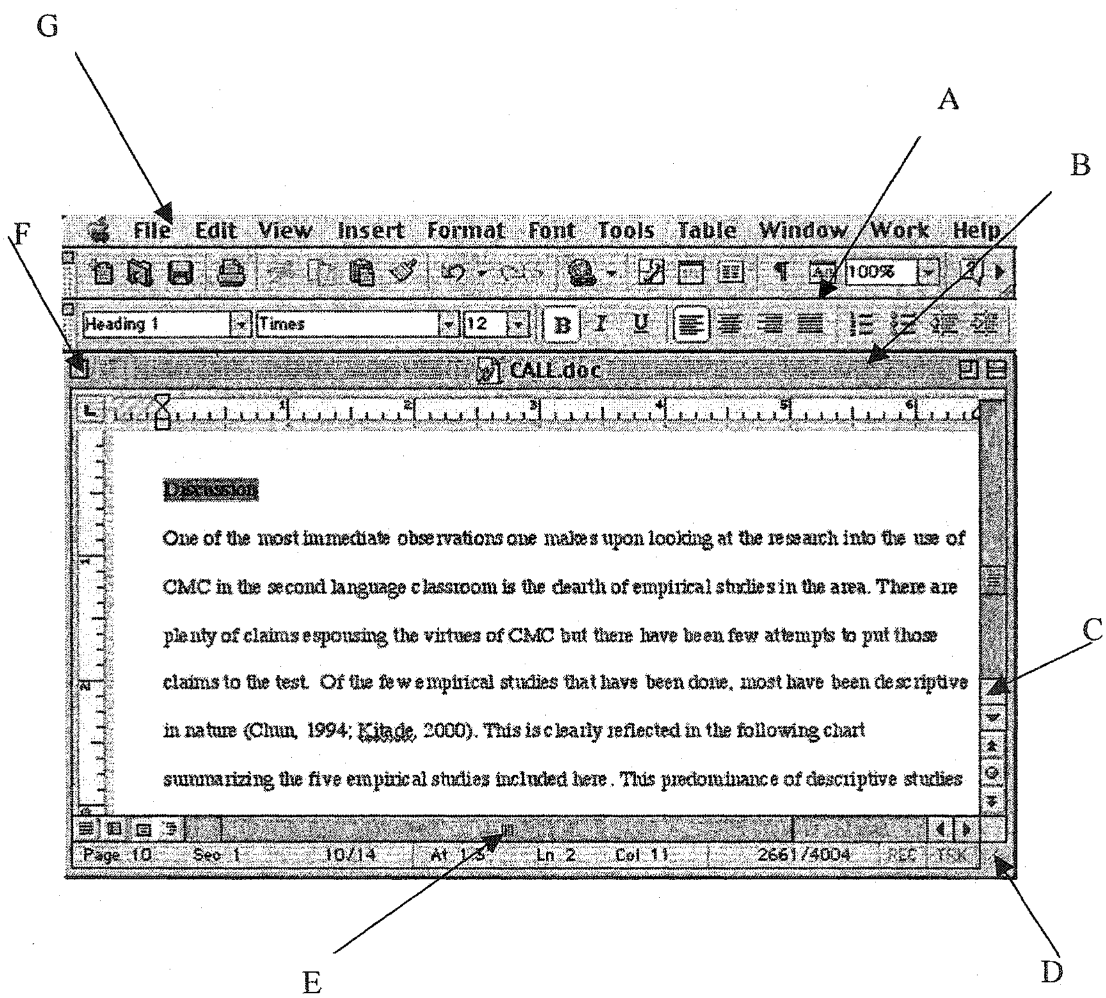
_______ Make the window bigger.

_______ Move the window.

_______ See the bottom of the page.

_______ Put the word **Discussion** in the center (middle) of the line.

_______ Print the page.



D. Look at the document that is open in the window below and answer the questions. If you don't know the answer, you can leave the question empty or write "I don't know."

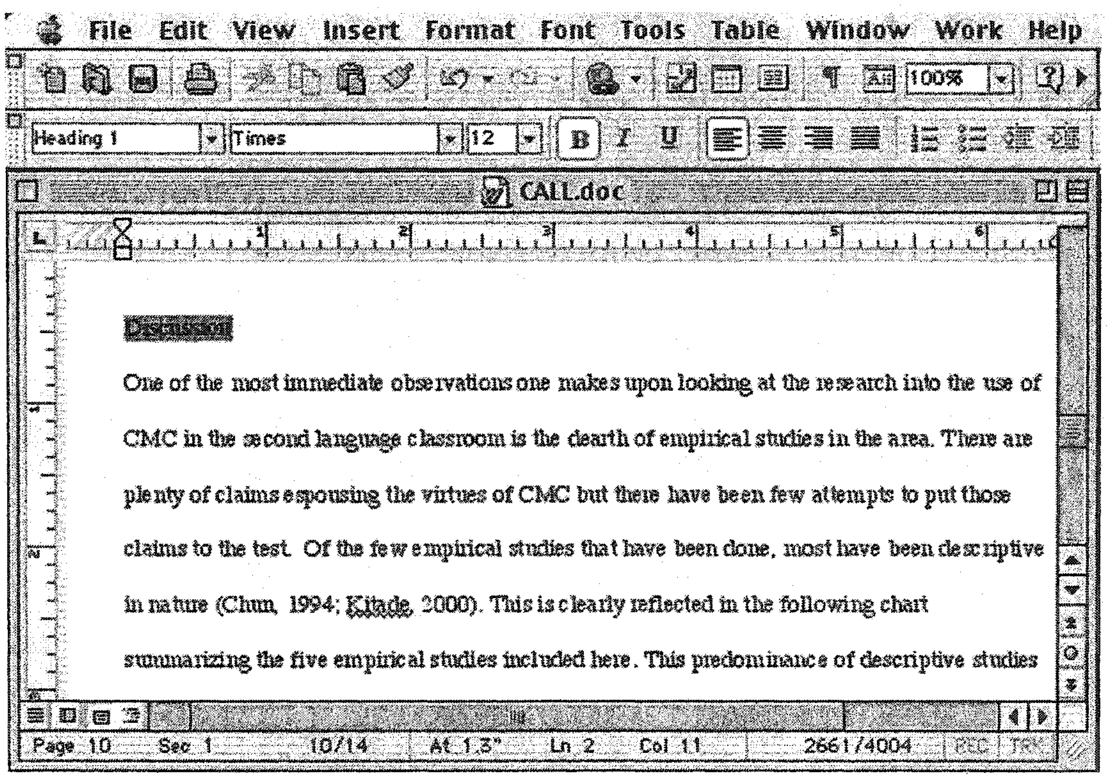
1. How many pages are there in the document?

2. What page are you looking at?

3. What word or words have been highlighted (selected)?

4. What size are the letters in the word *Discussion*?

5. What is the name of the document?



E. Circle *True* if the sentence is correct. Circle *False* if it is incorrect. Circle *I don't know*, if you don't know if the sentence is correct or not.

1. http://wwwhotmail.com is a correctly written Web address.	T	F	I don't know
2. Netscape Navigator is a software program used for getting information from the World Wide Web (WWW).	T	F	I don't know
3. You can connect to the Internet through the telephone line or cable.	T	F	I don't know
4. If something is on the Internet, it is probably true.	T	F	I don't know
5. The email address john.doe@someplace.ca is probably for someone in Canada whose name is John Doe.	T	F	I don't know
6. *Surfing the Web* means to go from page to page on the Web and only look at the pictures.	T	F	I don't know
7. A *Website* on the Web may contain only one page, or may be many pages connected together.	T	F	I don't know
8. A *browser* is someone who uses the computer a lot.	T	F	I don't know
9. *Links* are words or pictures that will take you somewhere different when you click on them.	T	F	I don't know
10. A *Search Engine* is a kind of program available on the Web that helps you find information.	T	F	I don't know

Computers in LINC - Processes/Procedures

Follow the teacher's instructions to find and open the C_LINC folder. Then, follow these instructions. Put a check mark after each item you have completed. If there is something you don't know how to do, check *I don't know how* and go on to the next item.

	Done	I don't know how.
1. Open the folder called C_LINC.	√	
2. Open the folder called OPENME		
3. Get rid of (throw away) the document *deleteme.doc.*		
4. Close the OPENME folder.		
5. Change the name of the document *changeme.doc* to *two.doc*		
6. Move the document *moveme.doc* into the folder called FILLME.		
7. Put a copy of the document *copyme.doc* into the FILLME folder		
8. Open the document *wp.doc.*		
9. Format the document so it looks the same as the model on the next page.		
10. Save your doucment as *letter.do*c and put it in the FILLME folder.		
11. Close the document.		
12. Open the document *Web.doc* and follow the instructions.		
13. Close the document.		

You are now finished the exercise. Please ask the teacher to help you hand in your work.

Thank you very much for your help!

This exercise asks you to go to a Web site and find some information. You may enter your answers here by clicking inside the question box, or you may write your answers for questions 1-6 on the last page of your handout. Question 7 must be entered here.

Click HERE to go to the web site.

1. What is the URL (address) of this Web site?
2. Whose Web site is this?
3. Click on **English** and then click on **VMC Exhibits** to find out which two exhibits are being featured right now. Write the names of the two exhibits.
4. How many games are there in total available on this web site?
5. When was the last time the information on this site was updated?
6. How can you contact the people who put this site on the Web?
7. Go to the Image Gallery. Look at the pictures available, choose one and put a copy of it here.

When you are finished, save your work and close this document.

2. To test vocabulary level and compare that level to the level used in a current piece of writing using the Compleat Lexical Tutor.

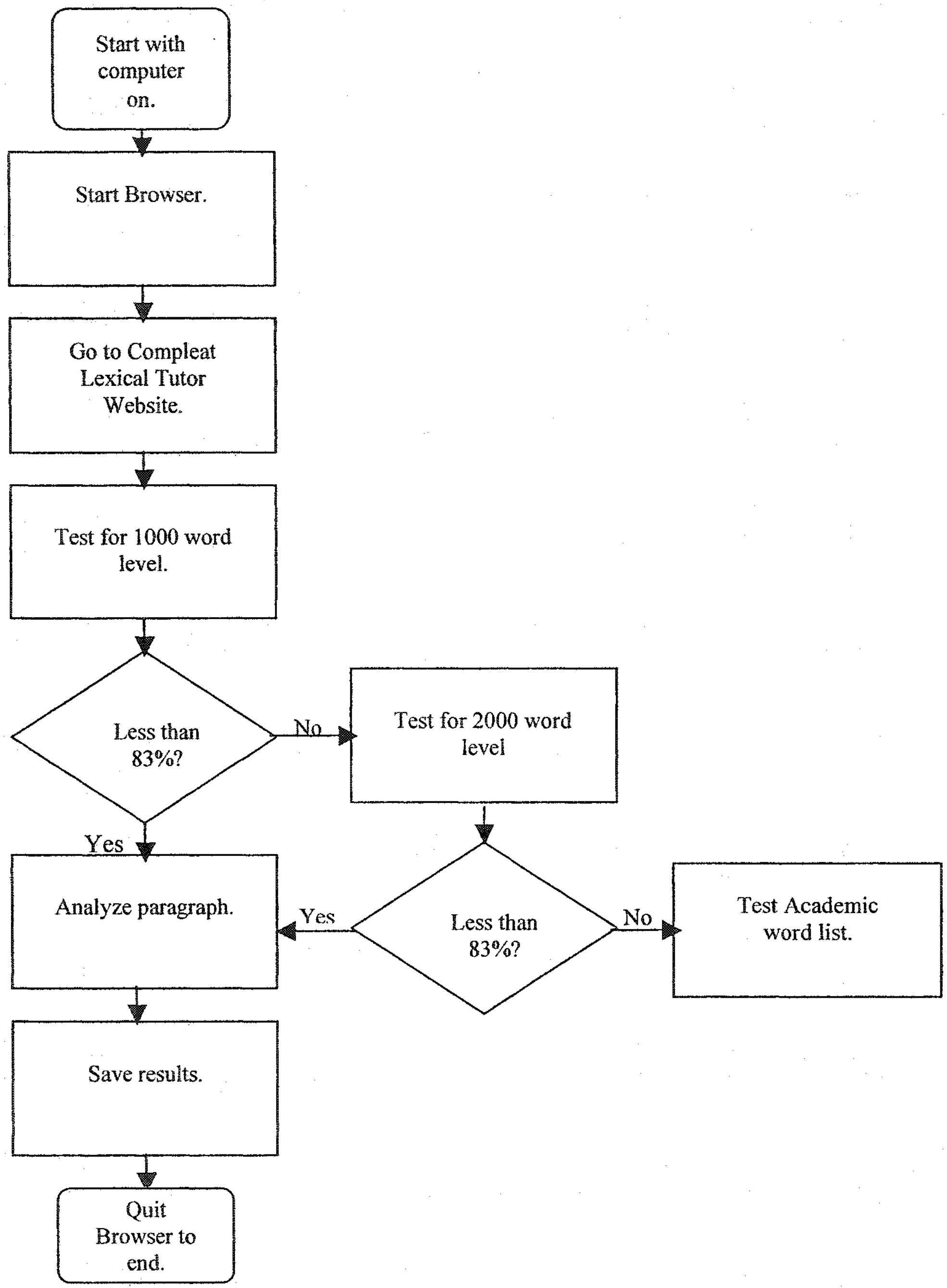


Figure B.1 Flow chart for task analysis of task 2

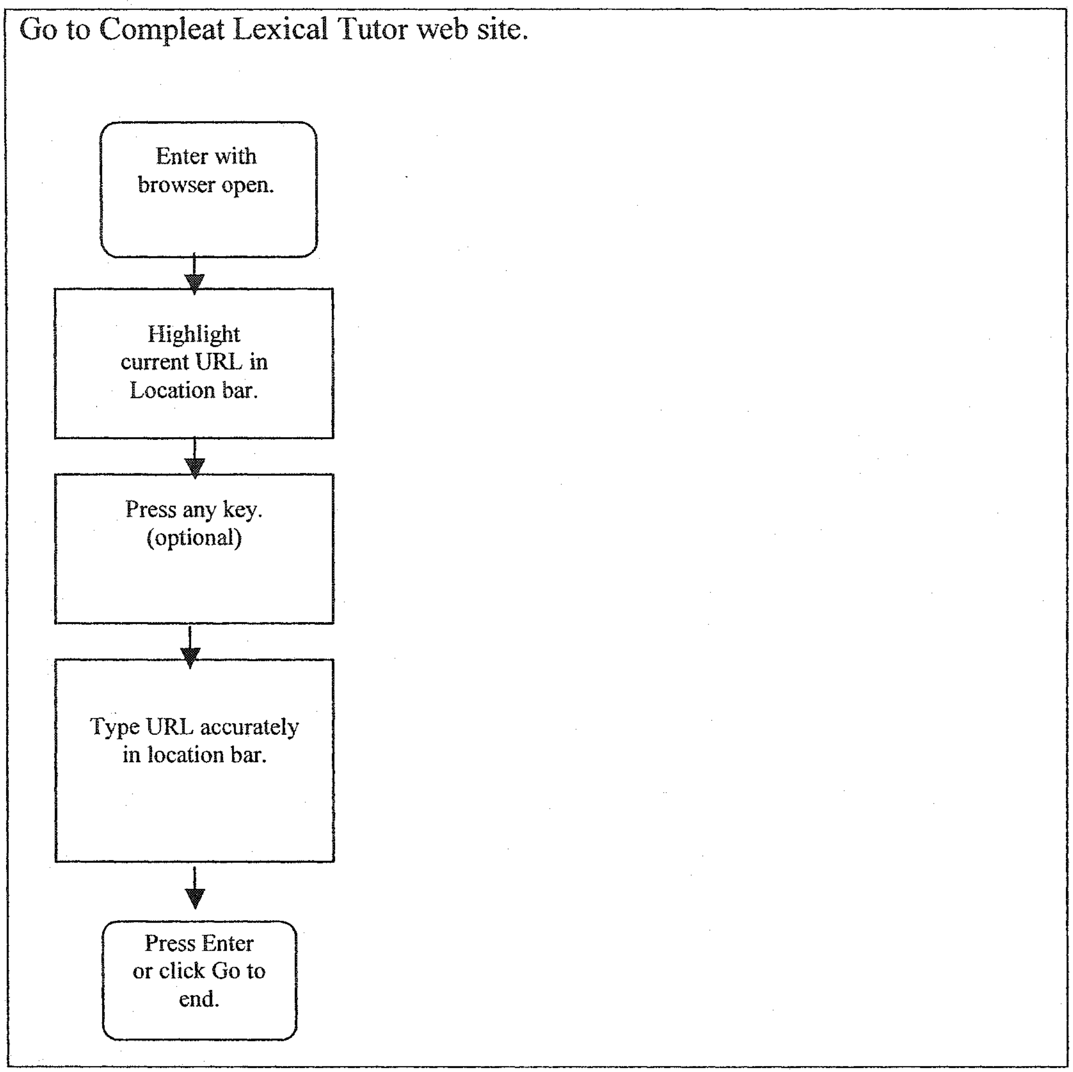


Figure B.2 Flow chart for task analysis of sub-task of task 2

Appendix C

Computer Literacy Questionnaire

Part 1: Tell me about your experience with computers. **Check the best answer.**

1. Do you use a computer at home? ☐ No ☐ Yes	2. Is it connected to the Internet? ☐ Yes ☐ No
If No, go to question 4.	3. How often do you use your computer? ☐ Everyday ☐ 4-6 times a week ☐ 1-3 times a week ☐ 1-3 times a month ☐ Less than once a month
4. Other than at school or home, do you use a computer more than once a week? (For example, at someone else's house, the library, or at work.) ☐ Yes ☐ No	
5. Do you have a personal email account? ☐ No ☐ Yes *If No, go to question 7.*	6. How often do you use email? ☐ Everyday ☐ 4-6 times a week ☐ 1-3 times a week ☐ 1-3 times a month ☐ Less than once a month
7. Did you use a computer before coming to Canada? ☐ No ☐ Yes	8. How often did you use it? ☐ Everyday ☐ 4-6 times a week ☐ 1-3 times a week ☐ 1-3 times a month ☐ Less than once a month
9. Have you ever taken a course about using the computer? ☐ No ☐ Yes	10. Was the course in English? ☐ No ☐ Yes
11. Have you ever taken a course about computer programming? ☐ No ☐ Yes *Finished!*	12. Was the course in English? ☐ No ☐ Yes

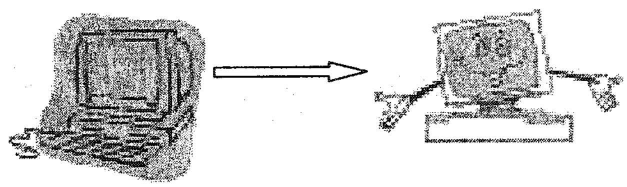
Part 2: Tell me what you can do on a computer.

Put an X in the box next to the best answer:

Yes, I can if you can do it on your own.
No, I can't if you can't do it, or if you can do it with help.
I don't understand if you don't know what the question means.

Can you........

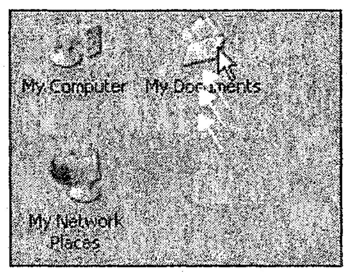
Example: Turn on a computer?



☒ Yes, I can.
☐ No, I can't.
☐ I don't understand.

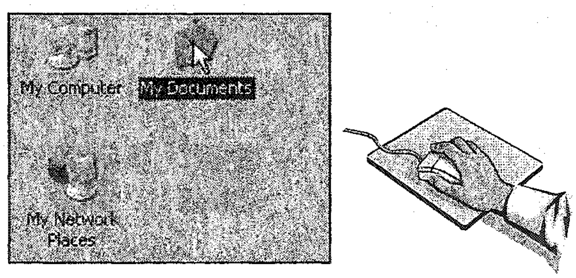
System

1. Move the pointer () on the screen?



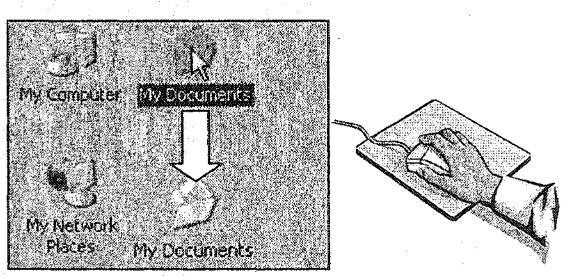
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

2. Use the mouse to click on things on the screen?



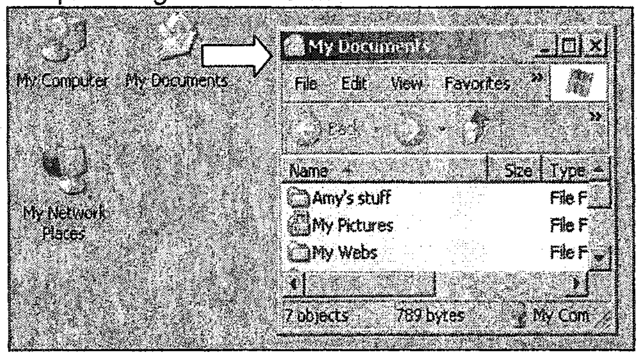
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

3. Use the mouse to move things on the screen?



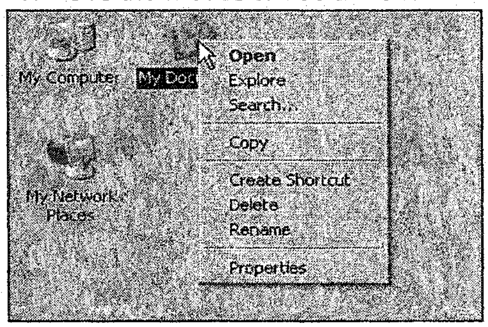
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

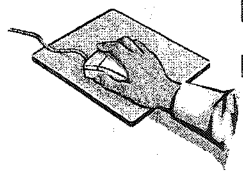
4. Open things on the screen?



☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

5. Use the mouse to see a menu?



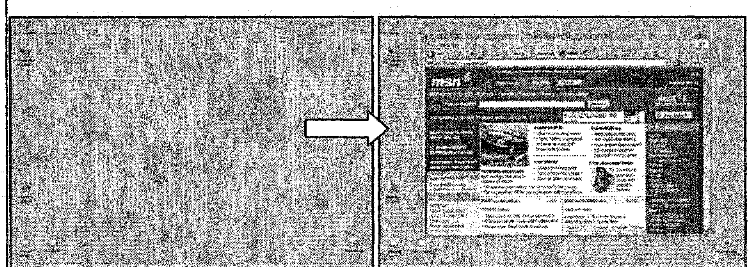


☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

6. Type without looking at your fingers most of the time?

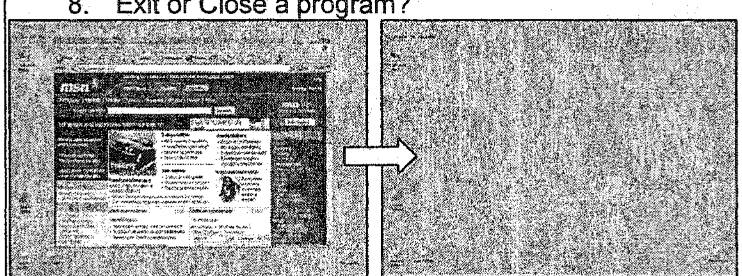
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

7. Start a program such as Internet Explorer or Microsoft Word?



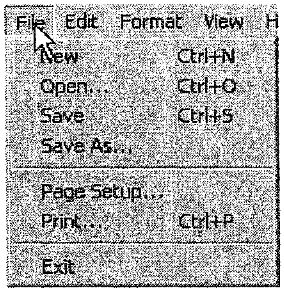
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

8. Exit or Close a program?



☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

9. Choose something from a menu?

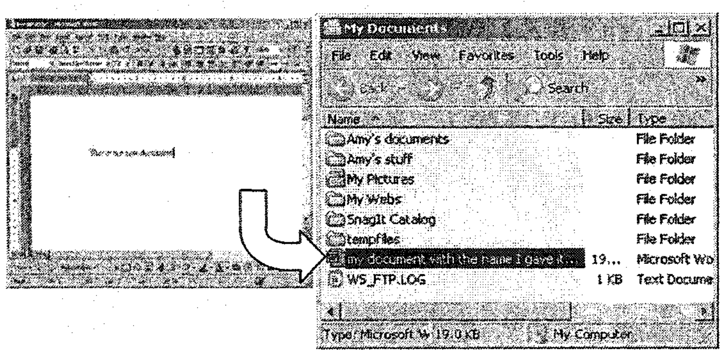


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

10. Save a document with a name you give it?

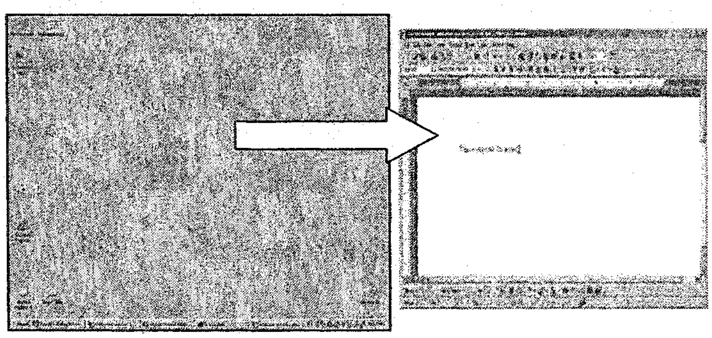


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

11. Find and open something that you saved before?

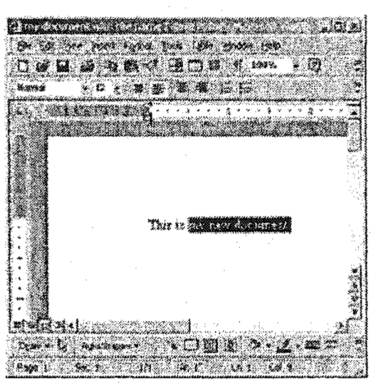


☐☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

12. Select or highlight words?

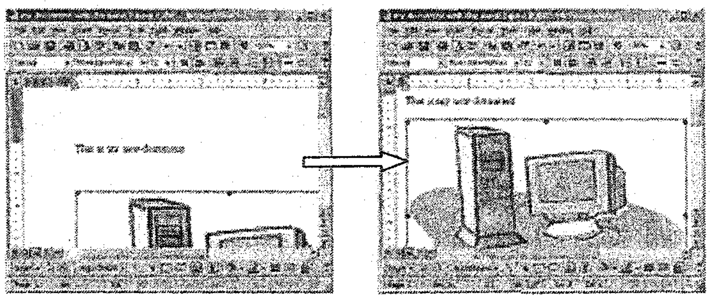


☐ Yes, I can.

☐ No, I can't.

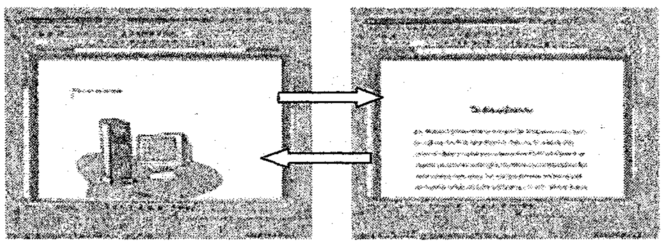
☐ I don't understand.

13. Move up or down a page to see something if it is not on your screen?



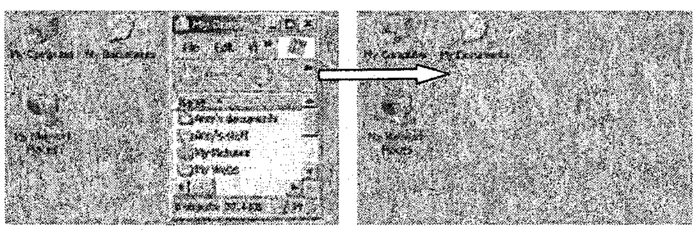
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

14. Work with more than one window at a time?



☐☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

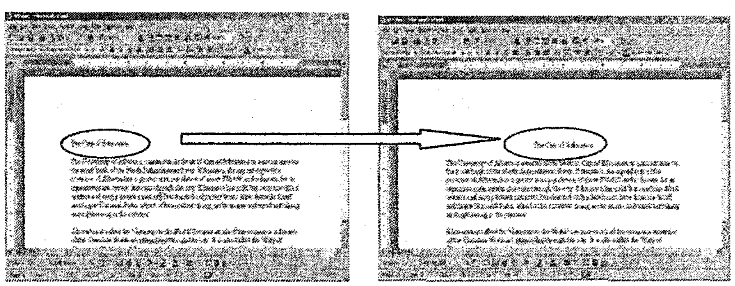
15. Close windows?



☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

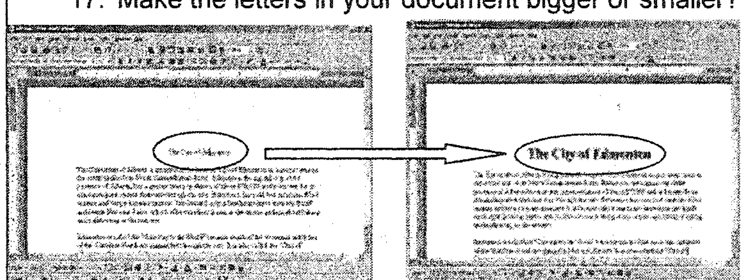
Word Processor

16. Put words in the center of a page?



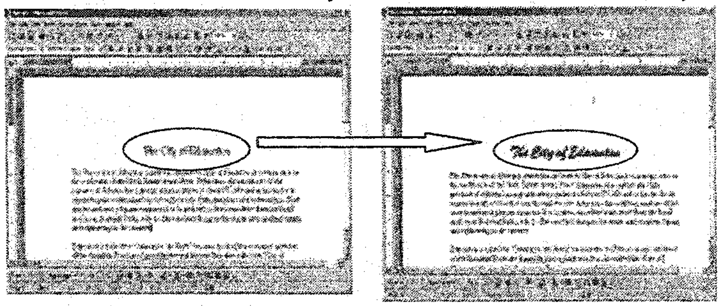
☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

17. Make the letters in your document bigger or smaller?



☐ Yes, I can.
☐ No, I can't.
☐ I don't understand.

18. Make the letters in your document a different shape?

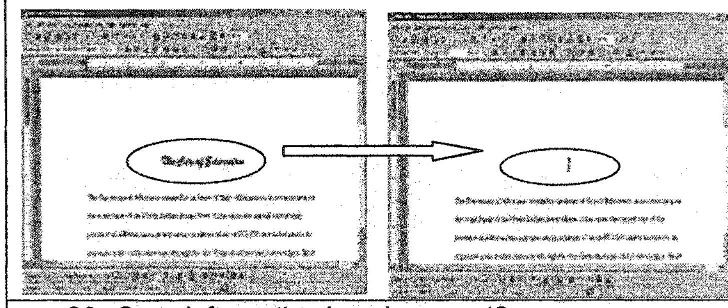


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

19. Erase information in a document.

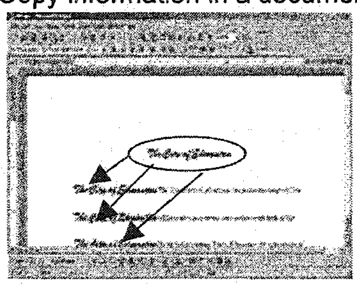


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

20. Copy information in a document?

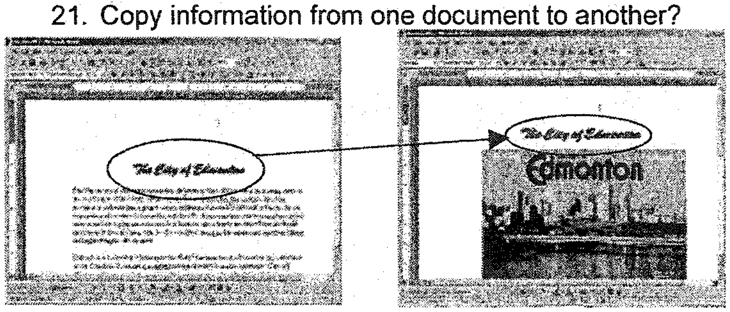


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

21. Copy information from one document to another?



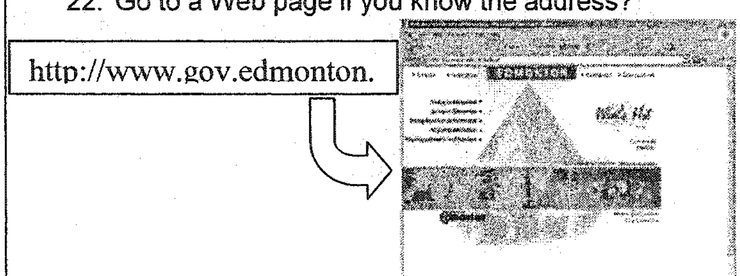
☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

Web Browser

22. Go to a Web page if you know the address?

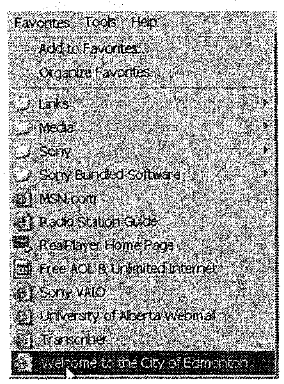


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

23. Save the address of a Web page so you can go there again without typing it in.

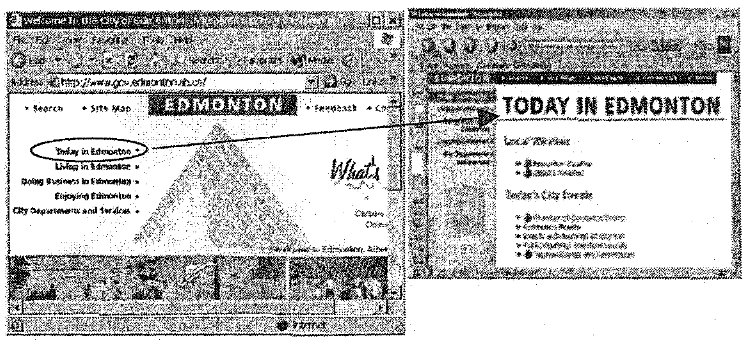


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

24. Follow links on a Web page.

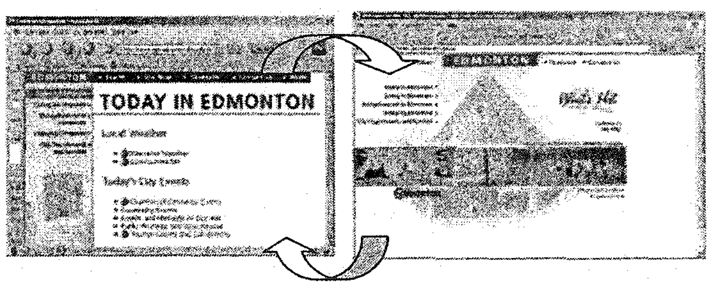


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

25. Go back and forth between web pages?

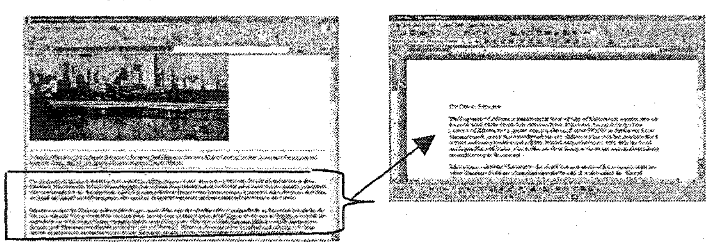


☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

26. Copy text from a Web page and save it in your document?



☐ Yes, I can.

☐ No, I can't.

☐ I don't understand.

Appendix D

Test of Computer Literacy

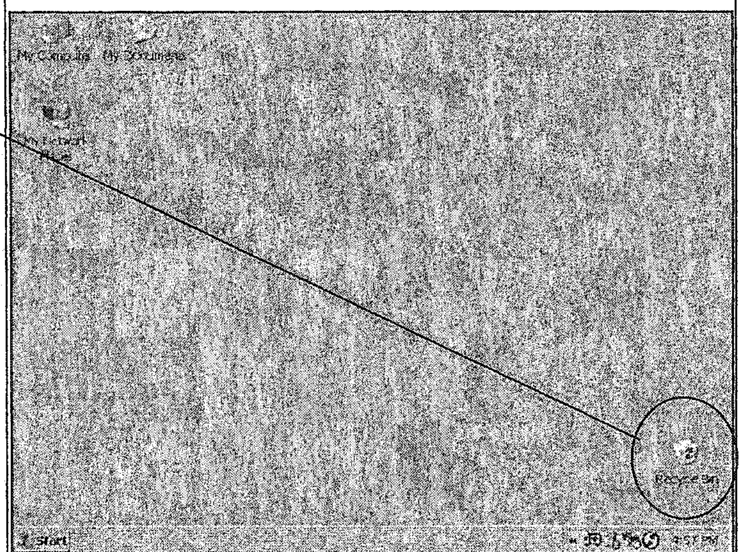
Part I

A. For each question, draw a line to the place in the picture where you need to click next in order to do what is stated. There is more than one right answer for some questions. You only need to show me one.

Example: I want to know what is inside the Recycle Bin.

1. I want to use the Internet.

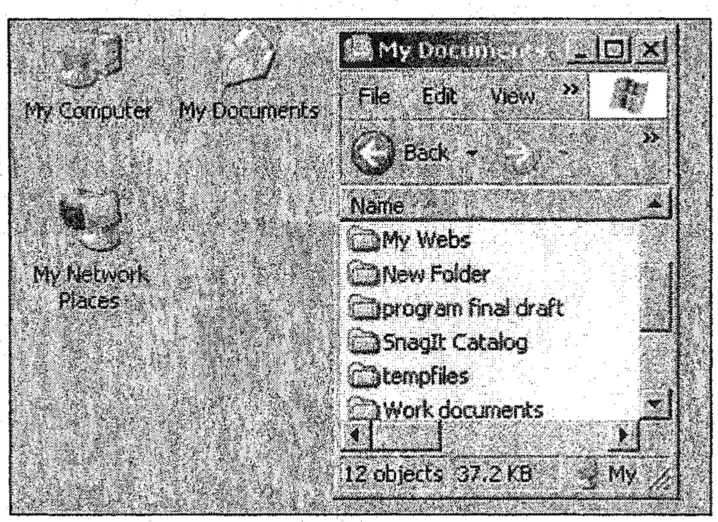
2. I want to open a document I saved before.

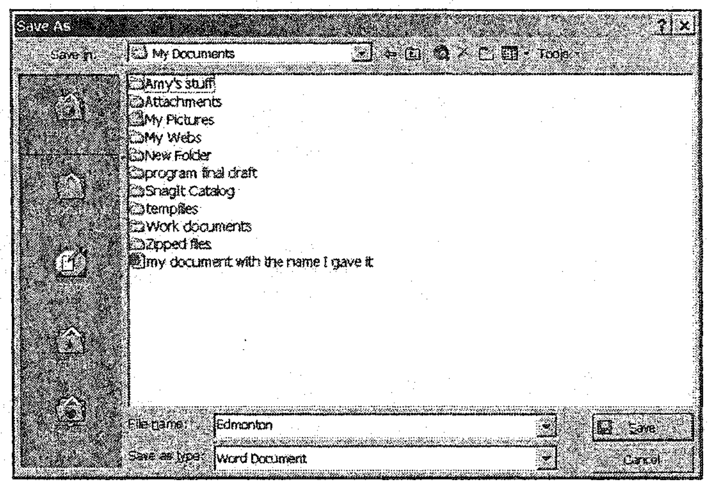
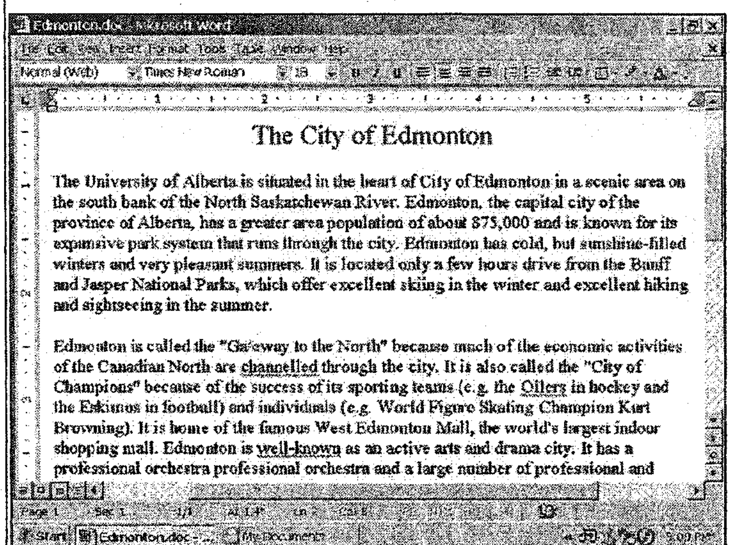


3. I want to open a document called *schedule* that I saved in the *Work documents* folder.

4. I want to open a folder called *Zipped documents* that is inside My Documents.

5. I want to close the *My Documents* window.



6. I want to change the title of this document. 7. I want to save this document in the *Work documents* folder.	
8. I want to minimize (hide) the window. 9. I want to maximize (show) the *My Documents* window again. 10. I want to Exit or Close the program I am using (Microsoft Word).	

B. Look at the word processing document that is open in the window below and write your answer for each question. If you don't know the answer, you can leave the question empty.

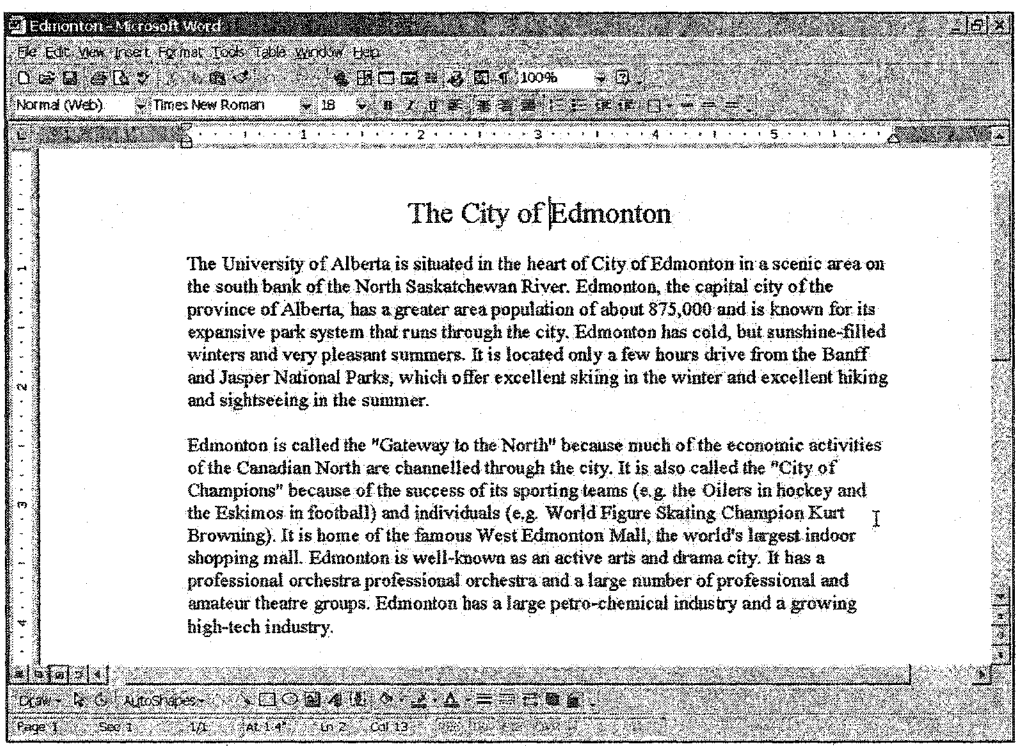
1. What is the name of the document?

2. What font (kind of letter) is the title in?

3. What size are the letters in the title?

4. How many pages are there in this document?

5. Are you sure that you see all the information that is in the document? If yes, why? If no, why not?



C. Look at the Web page that is open in the window below and write your answer for each of the questions. If you don't know the answer, you can leave the question empty.

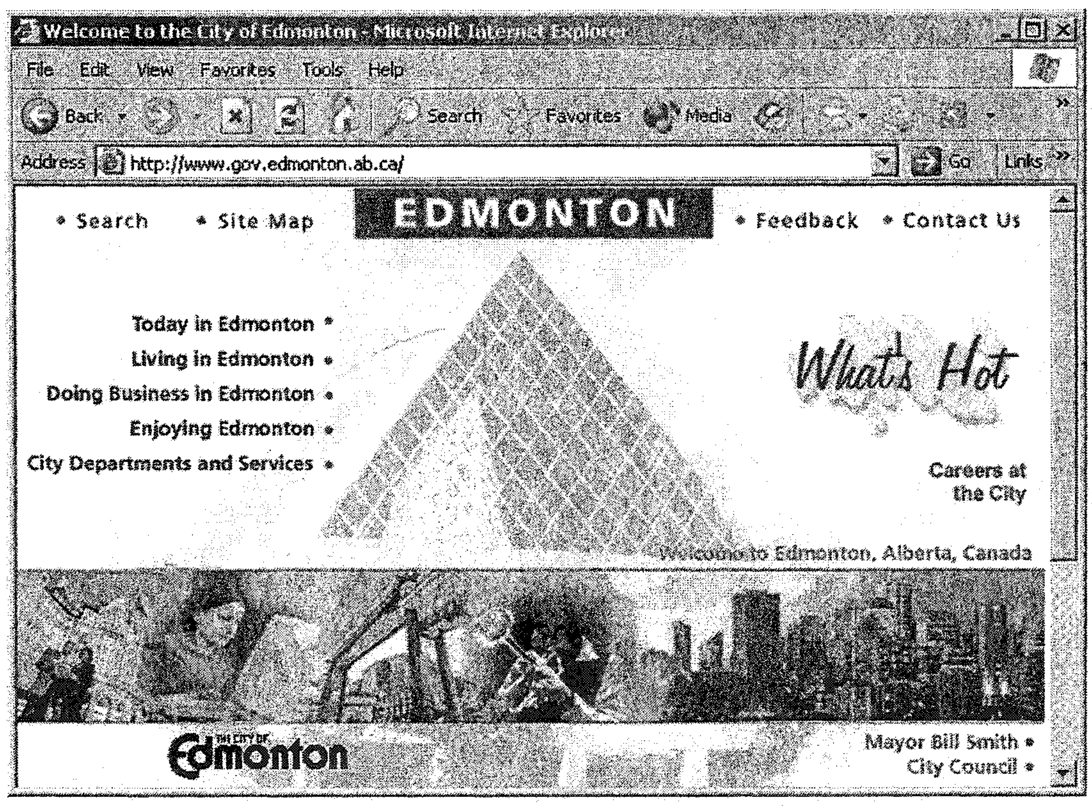
1. What is the address of this Web page?

2. What is the name of the Web page?

3. Where would you click if you wanted to go to the page you were at before this one?

4. Where would you click if you wanted to save this address?

5. Where would you click if you wanted to find out about living in Edmonton?



Part II. Vocabulary

A. Match the word with the instructions by drawing a line. An example is done for you.

Press

1. Double-click
2. Drag
3. Point
4. Click
5. Scroll

Move the mouse so the pointer (pointer icon) is on top of something.
Use the arrows on the side of the window to move the page up or down.
Quickly press the mouse button and let go of it two times.
Press the mouse button when the pointer is on something, hold the button down while you move the pointer to another place. Then, let go of the mouse button.
Press the mouse button once and then let go of it.
Push down. For example: push down the return key.

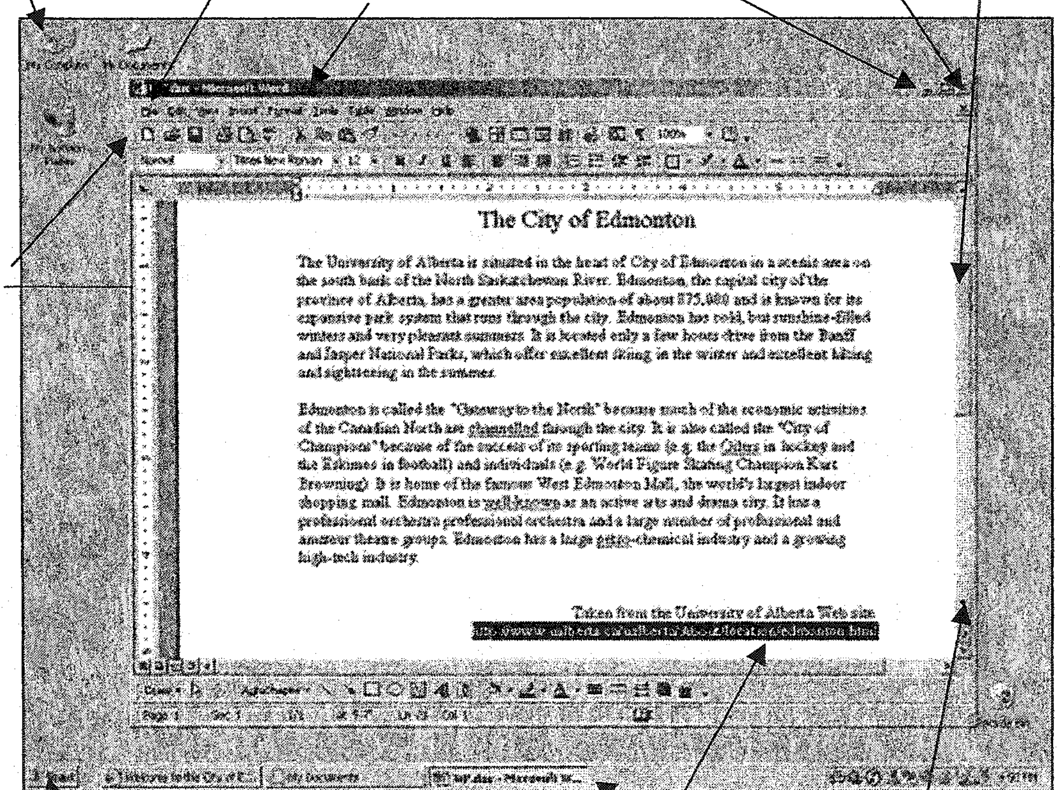
B. Write the names of the keys on the keys in the picture that have no name. Use these words. An example is done for you. You will need to use some words more than once.

Backspace   Space bar   Shift   Enter   Ctrl (control)   ~~Alt~~

C. Label the picture below by using these words. An example is done for you. You will not need to use all the words.

Close box	Edit Menu	Folder	Icon	Menu bar
Minimize box	Resize box	Scroll arrow	Scroll bar	Selection
~~Start button~~	Status Bar	Task bar	Title bar	Tool bar

2. ____________ 3. ____________ 4. ____________ 5. ________ 6. ________ 7. ________



1.

Ex. Start Button

10. ____________ 9. ____________ 8. __________

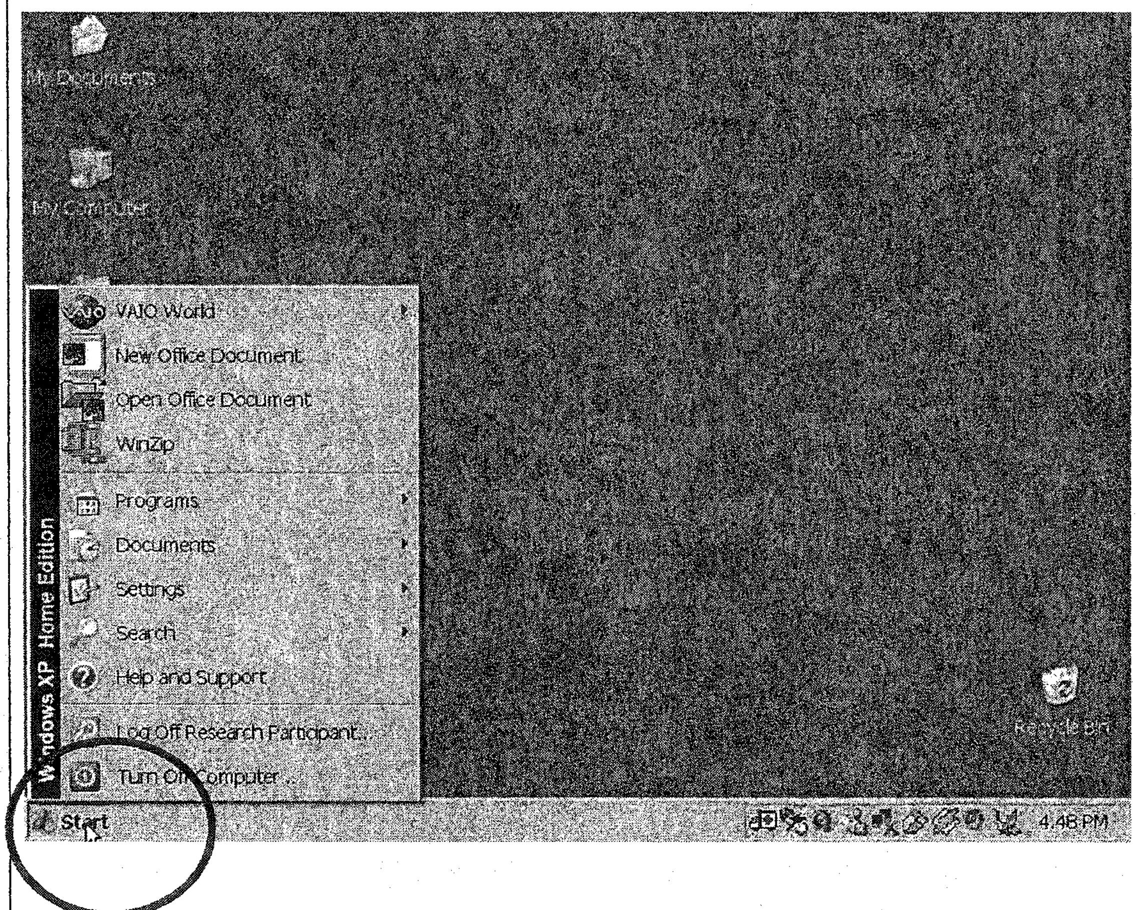
D. For each word or phrase, put an X the column that best describes you.

	I know this word.	I don't know this word.	I've heard this word but I don't know what it means.
1. Bold			
2. Browser			
3. Center			
4. Cursor			
5. Desktop			
6. Dialog box			
7. Folder			
8. Font			
9. Home page			
10. Italics			
11. Justify			
12. Left align			
13. Line spacing			
14. Link			
15. Paste			
16. Right align			
17. Save As			
18. Underline			
19. URL			
20. Word processor			

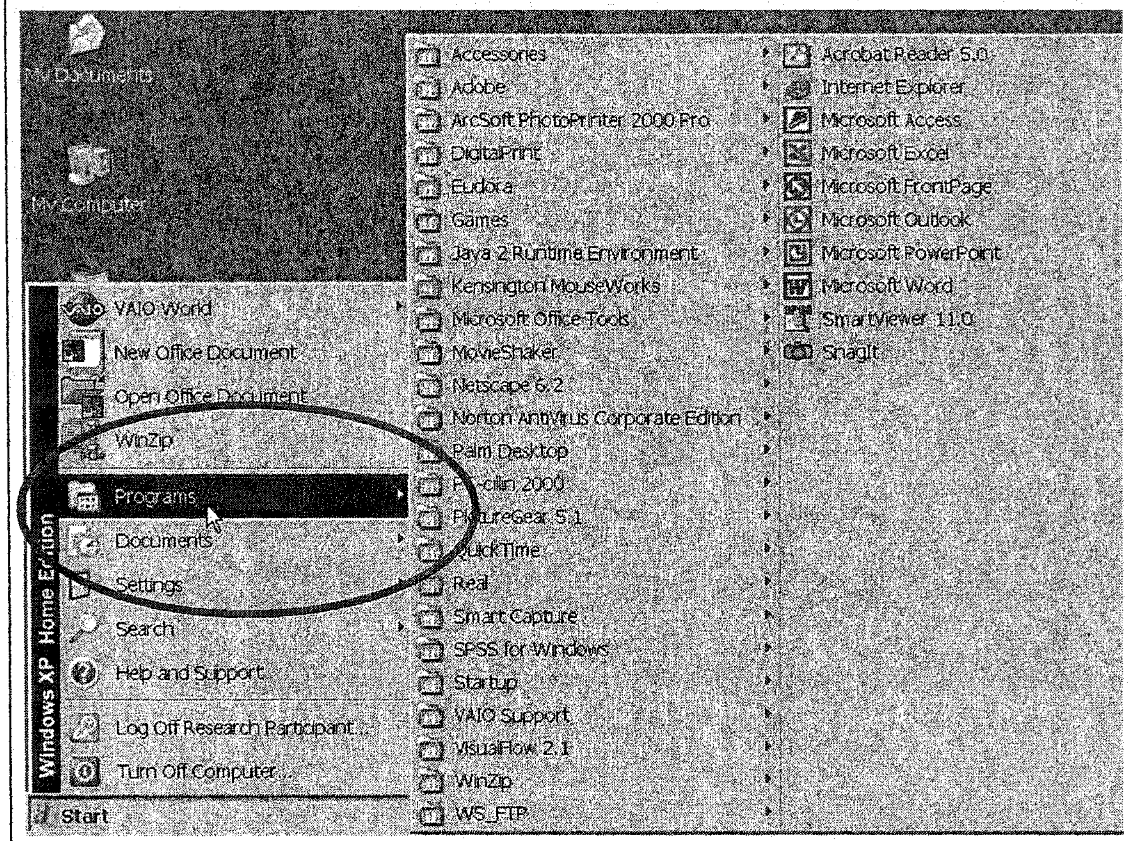
Appendix E

Sample Visual Cues Provided for Performance Test.

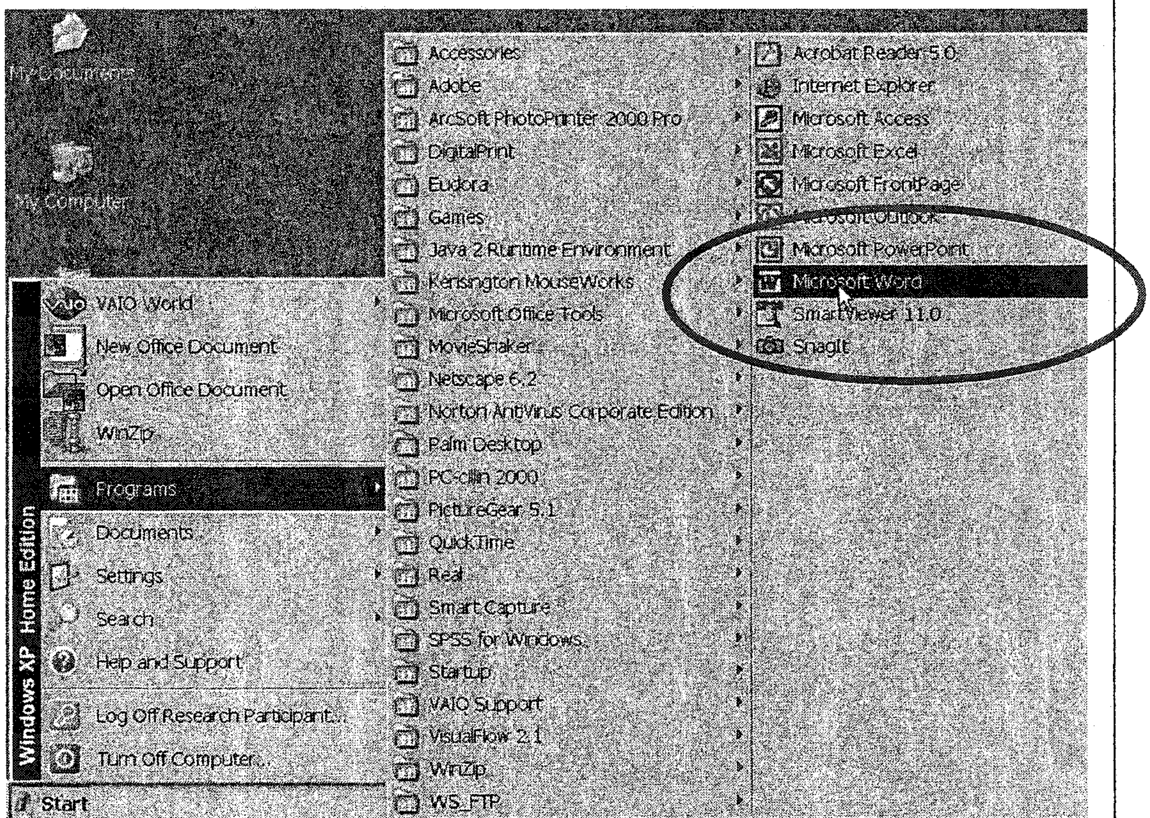
1a) Click on the ***Start*** Button.



1b) Point to ***Programs***.



1c) Select ***Microsoft Word***.



Appendix F

Computer Literacy Performance Test: Observation Checklist

Part A	Prompted	Directed	Completed	Hesitancy	Comments	Shortcuts	Score
Point to the Start button.							
1. Point							
Click on *My Computer*.							
2. Click							
Double-click *My documents*.							
3. Double-click							
Open the *File* menu.							
4. Select commands from a menu							
Select *Close*.							
5. Select commands from a menu							
Part B							
Start Microsoft Word.							
6. Start programs							
7. Select commands from a menu							
Type the words: *My City*							
8. Type (shift, keyboard, fingers)							
Save this document. Give it your name and put it in your teacher's folder in *My Documents*.							
9. Save a document for first time.							
10. Select commands from a menu							
11. Edit text (delete or replace)							
12. Type (shift, keyboard, fingers)							
13. Find folders and documents							
14. Open folders and documents							

	Prompted	Directed	Completed	Hesitancy	Comments	Shortcuts	Score
Minimize the window.							
15. Manage windows (minimize)							
Start Internet Explorer.							
16. Start Programs							
17. Select commands from a menu							
Go to this Web page: *D:\research\index.htm*							
18. Go to a website given a URL							
19. Edit text (delete or replace)							
20. Type (shift, keyboard, fingers)							
Go to the *Activity page.*							
21. Follow links							
Copy the paragraph from the web page and put it in the document you saved earlier.							
22. Scroll							
23. Highlight text							
24. Copy information from one document to another							
25. Select commands from a menu							
26. Manage windows (minimize and maximize)							
27. Edit text (insert, copy and paste)							
Save your changes.							
28. Save changes							
29. Select commands from a menu							
Exit or Close *Microsoft Word* and *Internet Explorer.*							
30. Quit programs							

Appendix G

Table 3.1 Missing and spoiled data in Computer Experience Questionnaire

ID	Item	Problem	Rationale	Action
1	#8. How often did you use a computer before coming to Canada?	Missing	During the Performance Test, this student indicated that she had used a computer at work 10 years earlier but not much since.	Assigned a score of 0.
15	#3, How often do you use a computer at home?	Missing	The items regarding frequency of use of email and previous use were both marked as 3-5 times/week. It is likely that frequency of use of the computer was similar.	Assigned a score of 1.
15	#6. How often do you use email?	Two choices selected.	Everyday and 1-3 times a week were both selected. Both are more than once/week.	Assigned a score of 1.
19	#9. Have you ever taken a course about using the computer?	Missing	Question #10 which asks if the course was in English was answered with a yes. Assumed he had taken a course.	Assigned a score of 1.
19	#11. Have you ever taken a course about computer programming?	Missing	During the Performance Test, reported using the computer for personal use. It is unlikely that he has taken any programming.	Assigned a score of 0.
19	#12. Was the programming course in English?	Missing	Given the information above, it was assumed the answer was no.	Assigned a score of 0.
23	#4. Other than at school or home, do you use a computer more than once a week?	Missing	No information available.	Left blank
26	#4. Other than at school or home, do you use a computer more than once a week?	Missing	This student frequently stated that she had never used a computer before. It was clear that the answer was no.	Assigned a score of 0.

Table 3.1 Missing and spoiled data in Computer Experience Questionnaire (continued)

ID	Item	Problem	Rationale	Action
27	6. How often do you use email?	Missing	During the Performance Test, indicated that the only experience with computers had been during an earlier ESL. It is unlikely that he uses it currently more than once a week.	Assigned a score of 0.
36	#4. Other than at school or home, do you use a computer more than once a week?	Missing	No information available.	Left blank
37	#4. Other than at school or home, do you use a computer more than once a week?	Missing	During the Performance Test, student mentioned only using the computer at home.	Assigned a score of 0.
46	#8. How often did you use a computer before coming to Canada?	Missing	During the performance, this students experienced difficulties controlling the mouse. This suggested that she had not used a computer very often.	Assigned a sore of 0.

Appendix H

Table H.1 Item analysis for Performance Test

	Objective	Item	IF	ID
1.	**Word Processing: The student is able to enter, save, and manipulate text.**			
	1.1 Edit text	24	0.28	**0.90**
	1.1 Edit text	27	0.33	**1.00**
	1.2 Apply formatting			
	1.3 Save a document with a name in a specified location	9	0.30	**1.00**
	1.4 Save changes to a document	28	**0.43**	**0.90**
2.	**Web: The student is able to access and navigate a specified web site.**			
	2.1 Go to a website, given a URL	18	**0.45**	**0.90**
	2.2 Save and use Favorites or Bookmarks			
	2.3 Follow links	21	**0.63**	**0.60**
	2.4 Use the navigation bar to move around a web site.			
3.	**Windows: The student is able to navigate a Windows platform.**			
	3.1 Start and quit programs	6	0.38	**0.90**
	3.1 Start and quit programs	16	0.38	**0.70**
	3.1 Start and quit programs	30	**0.63**	**1.00**
	3.2 Manage windows	15	**0.43**	**1.00**
	3.2 Manage windows	26	0.30	**0.80**
	3.3 Find folders/documents	13	**0.45**	**1.00**
	3.4 Open folders/documents	14	0.33	**1.00**
	3.5 Scroll	22	0.73	**0.70**
	3.6 Select commands from a menu	7	**0.48**	**0.80**
	3.6 Select commands from a menu	10	**0.43**	**1.00**
	3.6 Select commands from a menu	17	**0.55**	**0.80**
	3.6 Select commands from a menu	25	0.35	**1.00**
	3.6 Select commands from a menu	29	**0.53**	**1.00**
	3.7 Highlight text	23	**0.43**	**1.00**
	3.8 Delete/insert/replace text	11	**0.45**	**1.00**
	3.8 Delete/insert/replace text	19	**0.60**	**0.90**
4.	**Mouse: The student is able to control the mouse: point, click, drag, double-click.**			
		1	**0.45**	**0.70**
		2	0.30	0.40
		3	0.73	**0.80**
		4	**0.58**	**0.90**
		5	**0.68**	**0.90**
5.	**Typing: The student demonstrates familiarity with letters, punctuation and the keys: shift, space bar, delete or backspace and enter.**			
		8	0.38	**0.80**
		12	**0.50**	**1.00**
		20	**0.40**	**1.00**

Table H.2 Item analysis for Written Test of Knowledge

Objective	Part	Item	IF	ID
1. Word Processing: The student is able to enter, save, and manipulate text.				
1.1 Edit text	2	c9	0.26	**0.67**
1.2 Apply formatting	1	b2	0.33	**0.67**
1.2 Apply formatting	1	b3	**0.46**	**0.83**
1.3 Save a document	1	a6	0.30	**0.75**
1.3 Save a document	1	a7	0.30	0.33
1.3 Save a document	1	b1	**0.43**	**0.42**
1.3 Save a document	2	c4	**0.41**	**0.83**
1.4 Save changes to a document				
2. Web: The student is able to access and navigate a specified web site.				
2.1 Go to a website, given a URL	1	c1	0.87	**0.42**
2.2 Save and use Favorites	1	c4	0.17	**0.50**
2.3 Follow links	1	c5	**0.72**	**0.58**
2.4 Use the navigation bar	1	c3	**0.54**	**0.67**
3. Widows: The student is able to navigate a Windows platform.				
3.1 Start and quit programs	1	a1	0.15	0.08
3.1 Start and quit programs	1	a10	**0.61**	**0.83**
3.2 Manage windows	1	a5	**0.65**	**0.75**
3.2 Manage windows	1	a8	**0.48**	**0.83**
3.2 Manage windows	1	a9	0.15	0.17
3.2 Manage windows	2	c5	**0.65**	**1.00**
3.2 Manage windows	2	c6	0.72	**1.00**
3.2 Manage windows	2	c10	0.17	0.33
3.3 Find folders/documents	1	a2	0.87	0.25
3.3 Find folders/documents	1	a3	**0.46**	**0.42**
3.4 Open folders/documents				
3.5 Scroll	1	a4	0.11	0.17
3.5 Scroll	1	b5	0.33	0.17
3.5 Scroll	2	a5	0.37	**0.75**
3.5 Scroll	2	c7	0.35	**0.83**
3.5 Scroll	2	c8	0.33	**0.92**
3.5 Scroll	2	c8	0.33	**0.92**
4. Mouse: The student is able to control the mouse: point, click, drag, double-click.				
	2	a1	**0.57**	**0.83**
	2	a2	0.35	**0.67**
	2	a3	**0.52**	**0.92**
	2	a4	**0.50**	**0.83**
5. Typing: The student demonstrates familiarity with letters, punctuation and the keys: shift, space bar, delete or backspace and enter.				
	2	b1	**0.67**	**0.83**
	2	b2	**0.65**	**0.83**
	2	b3	**0.72**	**0.92**
	2	b4	**0.76**	**0.83**
	2	b5	**0.76**	**0.75**

Table H.3 Item analysis for Computer Skills Self-assessment

	Objective	Item	IF	ID
1.	**Word Processing: The student is able to enter, save, and manipulate text.**			
	1.1 Edit text	19	**0.65**	**1.00**
	1.1 Edit text	20	**0.52**	**1.00**
	1.1 Edit text	21	**0.48**	**1.00**
	1.2 Apply formatting	16	**0.65**	**0.92**
	1.2 Apply formatting	17	**0.63**	**1.00**
	1.2 Apply formatting	18	**0.59**	**1.00**
	1.2 Apply formatting	26	**0.50**	**1.00**
	1.3 Save a document	10	**0.57**	**0.83**
2.	**Web: The student is able to access and navigate a specified web site.**			
	2.1 Go to a website, given a URL	22	**0.65**	**1.00**
	2.2 Save and use Favorites or Bookmarks	23	**0.50**	**1.00**
	2.3 Follow links	24	**0.61**	**1.00**
	2.4 Use the navigation bar	25	**0.57**	**1.00**
3.	**Windows: The student is able to navigate a Windows platform.**			
	3.1 Start and quit programs	7	**0.65**	**0.92**
	3.1 Start and quit programs	8	0.74	**0.75**
	3.2 Manage windows	14	**0.54**	**1.00**
	3.2 Manage windows	15	0.76	**0.67**
	3.3 Find folders/documents	11	**0.59**	**1.00**
	3.4 Open folders/documents	4	0.83	**0.67**
	3.5 Scroll	13	**0.70**	**0.75**
	3.6 Select commands from a menu	5	0.85	**0.58**
	3.6 Select commands from a menu	9	0.80	**0.75**
	3.7 Highlight text	12	**0.67**	**0.92**
	3.8 Delete/insert/replace text			
4.	**Typing: The student is able to control the mouse: point, click, drag, double-click.**			
		1	0.96	0.17
		2	0.98	0.08
		3	0.96	0.17
5.	**Typing: The student demonstrates familiarity with letters, punctuation and the keys: shift, space bar, delete or backspace and enter.**			
		6	0.35	**0.83**