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END USER ABILITY:

A STUDY OF INDIVIDUAL DIFFERENCES

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled, "End User Ability: A Study of Individual Differences" by Kevin Grant Campbell in partial fulfillment of the requirements for the degree of Master of Business Administration.

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ABSTRACT

End user computing (EUC) has become a widespread phenomenon in today's business organizations. Achieving effective utilization of this technology is currently a major managerial concern. This field survey uses computer ability as a surrogate measure of effective utilization and evaluates its relationship to individual differences between end users. The study is based on data collected from 263 end users in three organizations. It relies on social learning theory as a theoretical basis for hypothesis development. The use of Pearson correlation coefficients and analysis of variance determined that computer anxiety, perceived relative advantage, perceived ease of use, and skill variety each have a significant relationship with computer ability. A multiple regression though, indicated that ease of use contributes little to the understanding of ability after consideration of the other three variables. The implications of the findings for management are also discussed.

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To Esther and my children (Christina, Victoria and Tiffany) for their enduring patience and understanding while I undertook this project.

To Dr. Malcolm Munro for his guidance, persistence and unfailing support.

"Je tiens impossible de connaître les parties sans connaître le tout, non plus que de connaître le tout sans connaître particulièrement les parties."

Blaise Pascal, Pensées, Chapter I

The man who thinks he knows something does not yet know as he ought to know.

I Corinthians 8:2

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CHAPTER ONE

INTRODUCTION

Over the past decade there has been a rapid expansion in end user computing (EUC), however, the end user's ability to effectively utilize the technology has not always kept pace. Some end users quickly develop ability and become what Panko (1988) refers to as "power users"; others do not progress beyond the basics. The intent of this study is to acquire an understanding of some of the individual differences between end users of high and low ability.

Corporations have invested many millions of dollars in end user computing. The economic return on these investments has been varied; some companies have reported success in their use of EUC while others have not. Concern for the effective and efficient utilization of these resources is increasing (Lee, 1986). Tsay and Solomon (1987) found that nearly one third of the accounting practitioners who responded to their survey felt their recent college hires were substantially naive concerning the use of computers. This is paradoxical when compared to the college respondents who reported placing a higher emphasis on student computer knowledge. It was estimated that the share of corporate computer resources utilized by end user computing would have grown from approximately 10%, in 1981, to 70% by 1990 (Alavi and Weiss, 1989). Another element of the return on investment desired by many of

these companies is to obtain an increase in their competitive advantage (Rackoff, Wiseman and Ullrich, 1985).

Part of the challenge in meeting these goals is how employees react to the introduction of computers, as an innovation, to their work settings. In almost every work environment there are individuals who have adopted the use of computers and have been highly motivated towards increasing their ability. There are others though, who dislike the computer and if given the choice would rather not have or use one. Many of these latter individuals never progress beyond the basics in computer related ability. Galagan (1973) observed that "a common concern ... is what makes people resist using computers and how that resistance can be overcome".

In a review of MIS literature Zmud (1979) concluded that individual differences play a major role in the success of information systems. It is individual differences which are likely to represent answers to why some end users acquire ability and others don't. Nelson (1990) reminds us that "MIS practitioners must cope with the social and political issues as well as the technical issues". The introduction of end user computing is not just a technical issue, it is also a social issue due to its impact on the people involved.

1.1 RESEARCH QUESTION

Lee (1986) saw two challenges for management: 1) to find effective ways of integrating computer technology with work activities; and 2) providing the requisite help and information needed in order to develop proficiency as a computer user. He states "the presence of PC's does not guarantee their effective utilization". This study will seek out some of the reasons why this statement is true.

The primary research question is: what individual differences are there between end users of high and low ability? A review of current literature indicates two types of individual differences which appear to be worth pursuing - perceptions and personality characteristics. These lead to the following subquestions:

Are perceptions of computers different between end users?

Do perceptions of their jobs vary between end users?

Is there a difference in anxiety and locus of control between end users?

1.2 DESCRIPTION OF STUDY

This study will pursue these questions using learning theory as a theoretical framework. Learning theory will provide a basis for understanding the ability differences between individuals. This theoretical framework provides an explanation of why people respond differently to similar situations in their environment. Although this is not an experimental study, the theory has been used to develop hypotheses. These hypotheses will help guide the direction of this research project (Emory 1985). The final chapters of this study describe the results obtained and implications for management in understanding and managing end user ability.

CHAPTER TWO

END USER ABILITY AND PRIOR RESEARCH

Much of the research in the areas of MIS and EUC has revolved around determinants of success. This study views end user performance as such a determinant. Cheney and Nelson (1988) stated that ability and motivation are the primary determinants of the effectiveness of an end user's performance. This chapter will describe the ability construct which will be used to answer some of the issues related to the success of EUC.

2.1 LITERATURE REVIEW

What constitutes success in MIS and EUC? A basic definition is generally agreed upon, however, measuring it has proven difficult. Success is viewed as an increase in the operating effectiveness of the organization which is brought about through use of the information system. Due to the difficulty of implementing this definition in a measurable form surrogate measures have been developed and used. Ives and Olson (1984) identified four surrogates which have been employed in previous research. These are information system quality, usage, satisfaction, and changes in user behaviour/attitudes. Those used most frequently though, appear to be information system satisfaction and information system usage.

Srinivasan (1985) points out that these represent two types of measurement. Usage is a "behavioral indicator" and satisfaction is a perceptual indicator.

A variety of studies have been performed by researchers with these types of measures. Trice and Treacy (1988) performed a review of literature in which utilization measures were employed. They concluded that usage has not always been measured well nor consistently. The authors argue that the lack of standardized measures and a tendency not to use objective utilization measures, when they were available, have stunted progress in this area. For example, Davis (1989) used a two item measure of usage in his study whereas Igbaria, Pavri and Huff (1989) utilized four different types of usage scales.

Other studies have focused on measurements of user satisfaction. In their review of success related MIS literature Ives and Olson (1984) included a review of studies using satisfaction as a dependent measure. This construct differs from the previous one in that the researchers were trying to measure the users' perceived level of satisfaction with an information system. Their argument is that the effectiveness of computer resources is positively correlated to the user's satisfaction with it (Ives, Olson and Baroudi, 1983). Some of the concern in this research area involved developing an adequately validated measurement tool. More effort has been put into trying to develop a standardized measure for this construct (Bailey and Pearson, 1983; Ives, Olson and Baroudi, 1983) than for usage.

Researchers have used these constructs in a variety of studies. They have looked at how organizational factors (Cheney, Mann and Amoroso, 1989), influence of user involvement (Doll and Torkzadeh, 1989), implementation factors (Barki and Huff, 1990), and user characteristics (Davis, 1989; Igbaria and Parasuraman, 1990), to name a few, affect these surrogate measures of success.

Surrogate measures have problems though. These problems arise from their inability to specifically measure the effectiveness of an information system across different research problems. Measures of satisfaction and usage cannot, for instance, describe the relative level of sophistication which different end users perform at. Their level of use can be very simplistic or very complex. Simplistic use, which represents low level adoption, is not as effective in the use of organizational resources as higher levels of adoption would be. Although these measures have been useful and do serve their purpose, their usefulness is dependent on the research question being posed.

2.2 END USER ABILITY

Ability is a concept and as such "falls into the category of a hypothetical construct" (Goslin, 1963). It "refers to the extent to which the individual possesses the aptitude or skills to perform the tasks at hand" (Wexley and Latham, 1991). It is useful in that it allows the study of differences between end users. End user ability is the behavioral potential which results from prior learning. The remaining determinant for skilled performance is the motivation of the end user. That is, whether the user perceives it to be in his best interest to perform the behaviour.

Performance is the outcome of the interaction between the user's ability and motivation (Lawler, 1966). According to this model, performance will be low if either ability or motivation are low. Performance is a behaviour and, since it is the product of ability and motivation, may not interact with the independent variables in the same way as ability or motivation themselves.

User sophistication is a concept which has contributed to the development of the ability construct. When discussing the concept of application maturity Huff, Munro and

Martin (1988) stated that "both users and their applications become more sophisticated as time passes and experience increases." This implies that sophistication describes a continuous scale of development. Since sophistication is descriptive of the quality of the behaviour performed, it must therefore describe a range of ability relative to experience and learning gained. This is consistent with Huff, Munro and Martin (1988) who included knowledge and skill aspects to the construct by stating that "individuals strive to acquire new skills and solve problems by developing more complex and mature applications". Lee (1986) adds another aspect when he states that sophistication is better defined by the variety of applications used rather than the number of hours using a computer.

By definition an end user is someone who has already made an initial adoption decision regarding use of a computer. This adoption of computer technology can be characterized by either one time adoption or the opposite extreme of never ending adoption. The extent to which an individual continues to adopt will determine the amount of learning which occurs and the level of ability acquired. Decisions regarding the adoption of an innovation result from learning and will reflect the user's willingness to learn about the innovation. These innovations need not be new technological breakthroughs but will be ideas, methods or objects which are perceived as being new by the end user (Rogers, 1983). According to Moore (1987) there are three types of innovation. These are adoptive innovation, use innovation and implementation innovation. Adoptive innovation describes how early the user is relative to his/her peers in adopting new technology. The earlier the user adopts the more opportunity for learning to have occurred. Use innovation describes the degree of skill or range of new activities he/she uses the computer for. For instance, if the user attempts a new feature or a new application package they are exhibiting the capability which developed through their learning. Finally, implementation innovation describes when a

user uses the computer more frequently for the same purpose. This indicates a user who has grown comfortable with the ability that has been learned regarding that innovation. Through being innovative end users are exposed to new ideas, methods and information regarding end user computing. From this exposure they are able to learn and acquire increased levels of ability and become more effective in their utilization.

The research approach in this study is different from what has taken place previously on the issue of effective utilization of computer resources. It is necessary to consider the relative ability of end users in order to obtain a practical measure of effective utilization. As a result, this study will use ability as a surrogate measure of the successful use of EUC and will look at individual differences in relation to it.

2.3 SUMMARY

In this study the success of end user computing is theorized as being dependent upon the degree of sophistication practised by an end user - that is, how skilful is the end user in his/her utilization of computer resources. The level of sophistication at which the user performs is a product of his/her ability and motivation. Ability results from the learning which has taken place regarding computers. This study will examine user's perceptions which influence the learning of computer related ability.

Currently, research is required which will develop an understanding of end user ability. From this knowledge, a better awareness of the requirements for effective utilization of end user computing can be acquired. This will be done by studying the relationships between individual perceptions and ability.

CHAPTER THREE

DISCUSSION OF THEORY

A theory's role is to explain what has been observed and to infer areas of search for more information (Ghiselli, 1964). The theory itself is only a representation of the real world, but it is useful in providing a sound basis from which to work and to guide progress. The following discussion of learning theory presents a theoretical foundation from which a better understanding of end user ability and its development can be obtained.

3.1 INTRODUCTION

There is no single definition of learning which is agreed upon by all theorists. The definitions vary according to the particular bias of the researcher's theoretical perspective. There is a consensus though which can be gained from these various views. Learning is a relatively permanent change in disposition or behavioral potentiality that comes from experience (Bigge, 1982; Gagne, 1977; Good and Brophy, 1986; Hergenhahn, 1988). This means that learning constitutes a change in the "knowledge, skills, attitudes, values, or expectations" which are possessed by an individual (Bigge, 1982). Since learning must be relatively permanent change it excludes conditions which are temporary in nature such as from random behaviour, the effects of drugs or fatigue. In addition, learning results from

experience rather than changes produced through growth and maturation. Learning has occurred when a new ability is acquired. "The performance that accompanies the learning of a new capability is simply a verification that learning has occurred" (Gagne, 1977).

Gagne (1977) states that there are five varieties of capability which are learned and that these types are comprehensive. They are:

> Attitudes - acquired mental states which moderate personal choices;
>
> Motor skills - execution of movements in an organized manner;
>
> Verbal information - ability to relate a series of events or facts, whether to oneself or to others;
>
> Intellectual skills - allow the individual to interact with their environment through the use of symbols;
>
> Cognitive strategies - skills and strategies by which a person manages their own thinking, learning and remembering.

Attitudes are considered by many theorists to be an important influence on behaviour. They are generally referred to as an enduring feeling, or affective response, towards a person, object or issue. Beliefs are the information we possess about other people, objects or issues and they may or may not be factual. Beliefs are believed to be the foundation on which attitudes are formed.

Since most human behaviour is simply the application of what has previously been learned, knowledge of the learning process will help our understanding of ability. There are numerous theories on the learning process, each with its own champions. Bigge (1982) states that this "is not a field of study characterized by a body of theory that is internally consistent and accepted by all ... and no theory can be found to be absolutely superior to all others". Theories of learning predominantly fall into two categories referred to as behavioral and cognitive theories.

3.2 BEHAVIORAL THEORY

Behavioral learning theories are those which primarily rely on stimulus response conditioning to describe changes in behaviour. Learning occurs from the individual's direct experience with his environment. These theorists postulate that the only way learning can be determined is through objective empirical measurement of behaviour and that the intent of learning is to alter observable behaviours in order to meet a particular goal. Rewards are frequently utilized in order to reinforce a behaviour and increase the probability of its repetition. B.F. Skinner is a behaviourist who has shown that through successive approximation new patterns of behaviour can be acquired by an individual. He has demonstrated that operant conditioning can be very effective in obtaining desired behaviours.

Behavioral theories do have difficulties in explaining some learning processes. Bandura and Walters (1963) point out that behavioral theories fail to account for novel responses which develop from a subject's observation of a model. He argues that these theories account only for direct reinforcement and not for the vicarious reinforcement by which a subject will modify his behaviour based on observing the reinforcement given to others. Bandura (1977) also states that "a theory which denies that thoughts can regulate actions does not lend itself readily to the explanation of complex human behaviour". Behaviourism's weakness is that it does not allow for cognitive processes which in themselves may modify or reinforce behaviour.

3.3 COGNITIVE THEORY

Cognitive learning theories are those which view learning as a mental process. Learning is based upon an individual's perception of the world and the processes by which these perceptions are organized in a meaningful way. Cognitive theories are holistic in their

view of a person's perceptual field and to break up these perceptions into individual elements loses the connective meanings of a person's thinking process. Practitioners "believe that whatever happens to a person influences everything else about him", that people and their thoughts are "dynamic interrelated systems" which cannot be considered in isolation from each other. "Things such as beliefs, values, needs, and attitudes also embellish what we experience consciously. This means, or course, that people in exactly the same physical environment will vary in their interpretation of that environment and, therefore, in how they react to it" (Hergenhahn, 1988). To these theorists, an individual's beliefs about the environment are extremely powerful as determinants of learning.

The major argument which is raised against the use of cognitive theories is the subjective nature of the evaluation of internal thought processes or as stated by Skinner (1987) "speculating about internal processes which they have no appropriate means of observing". Even with this objection, cognitive theories are becoming more widely accepted as an explanation of the learning process. There are other researchers though who see merit in both schools of thought and have blended elements of both to form what Bigge (1982) refers to as "eclectic behaviorisms".

3.4 SOCIAL LEARNING THEORY

One theory which falls into the category of eclectic behaviorism is social learning theory. This is the name given to Bandura's theory on observational learning (Hergenhahn, 1988). Social learning theory did not originate with Bandura, but he made a major contribution to it through his insights on observational learning. The key element of Bandura's theory is "the ability to learn a behaviour without the need to reproduce it" (Hergenhahn, 1988). Bandura and Walters (1963) state that observation is an indispensable

part of learning. He points out that even in cases where stimuli are available for inciting an approximation of the desired behaviour, the learning process can be considerably shortened. when using social models. Under these conditions the subject is not performing the behaviour nor receiving direct reinforcement, but is acquiring the modeled responses in cognitive forms only (Bandura, 1969). In essence, it describes "the tendency for a person to reproduce the actions, attitudes, or emotional responses exhibited by ... models" and obtained through observation (Bandura and Walters, 1963). The observer would be reinforced vicariously as a result of witnessing the behaviour of other people and the consequences it has for them. He believes learning continues as a mental process by thinking about what has been observed. The previous social learning experiences of an individual may also modify his responsiveness to the social influences provided through reinforcement or modeled behaviour (Bandura and Walters, 1963). These previous learning experiences encompass the knowledge, beliefs, attitudes, motor skills, etc. which have been acquired already. The characteristics which have been developed in the individual will influence his perception of his environment and how he will interpret observed behaviours and reinforcements. The main functions which affect the degree of observational learning are (Bandura, 1969):

Attention - discriminative observation of the object of learning;

Retention - of the behaviour must occur in memory;

Motor Reproduction - of the behaviour until an acceptable match to the behaviour is achieved;

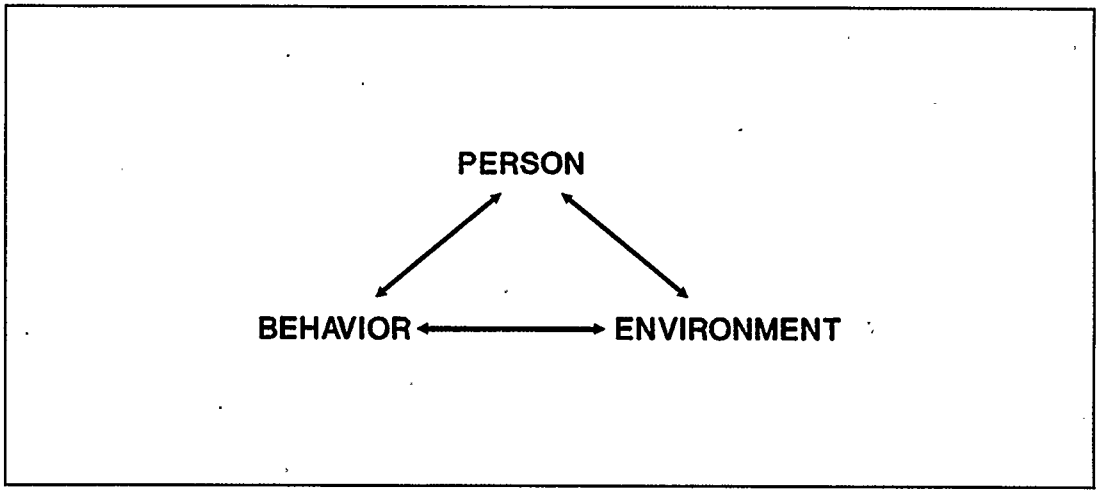
Motivation - adequate incentives to perform the behaviour on a consistent basis.

Bandura contends that a behaviour will be performed only when the subject believes it is in his best interest, or has sufficient incentive, to perform it. According to the theory, people are self regulators and are capable of rewarding or punishing themselves. Motivational

factors or anticipated reinforcements may either augment or reduce the chance the individual will perform the modeled behaviour, depending on how they are perceived.

In answer to the question, "why do people behave as they do?", social learning theory describes the interaction between the person, his environment and his behaviour (See Figure 1). Bandura describes the concept of reciprocal interaction as a relationship where

Figure 1 Reciprocal Interaction



each construct interacts with the others to determine human behaviour. In this model none of the components can be looked upon individually as a determinant of the others. It is within this framework that learning takes place. The elements change their relative balance and interactively influence each other on a continual basis. It is this changing balance which influences the diversity of human behaviour. "To the extent that newly established patterns of behaviour create favourable reciprocally reinforcing processes, they will be effectively sustained over time" (Bandura, 1969).

In applying social learning theory to the learning of end users it is possible to speculate that when a person interacts with a computer they cognitively perceive any

similarities to prior learning. Similarities which are found will be evaluated for the value of the potential reinforcement. A novice user may not have any previous learning which he considers similar. As a result, he may initiate his learning by observing modeled behaviour or gaining his own direct experience. Through his personal experience he will receive direct reinforcements to his behaviour. The beliefs he forms about the observed behaviour will either augment or impede the cognitive and motor skills required to perform the task. This in turn will further influence the learning of attitudes related to use of a computer. Thinking about what has been observed will either reinforce old attitudes or result in new ones being learned. In addition, cognitive strategies will be learned related to using the new tools by thinking about and rehearsing mentally what has already been retained. The learning process therefore provides information regarding knowledge, motor skills, attitudes and cognitive strategies towards using a computer. The significance of modelling in spreading innovations was described by Brancheau and Wetherbe (1989). They stated that "individual adoption is not an instantaneous act, but a process that occurs over time". They indicated that colleagues were the most influential source of innovation information and that modelling was most effective when done in the user's work environment by peers, particularly if those peers were opinion leaders.

Learning will not take place however, if the end user is not motivated. It is only through motivation that attention and retention occur. If the user is not motivated he will not attend to the observation and most certainly will not retain what has been observed. In addition, the end user will not perform the learning which has occurred if he does not perceive it to be in his best interest.

Attitudes have a significant impact on motivation. A great deal depends on what the person thinks about performing a behaviour. Although attitudes cannot be taught, they are

learned and can be influenced through the learning process (Good and Brophy, 1986). To motivate an end user to continue the learning process any negative attitudes must be replaced by positive ones or else stronger external inducements to action will be required (Good and Brophy, 1986).

3.5 SUMMARY

Social learning theory provides a basis from which an understanding of the learning process can be developed. In the context of end user computing, this theory describes the acquisition of: 1) information about computers; 2) motor skills; 3) cognitive strategies for using a computer; and 4) attitudes towards using them. It shows that learning occurs through our own direct experience or through observing the experience of others and receiving vicarious reinforcement. In addition, learning can be both a cognitive and behavioral process.

The discussion of social learning theory sets a framework from which to understand development of end user ability. Included in this discussion has been the development process of behavioral potentiality, as well as the motivation to perform acquired ability on a consistent basis. Other theories also contribute to the understanding of this complex process, but what has been described sets a suitable basis from which to understand this study.

CHAPTER FOUR

DEVELOPMENT OF HYPOTHESES

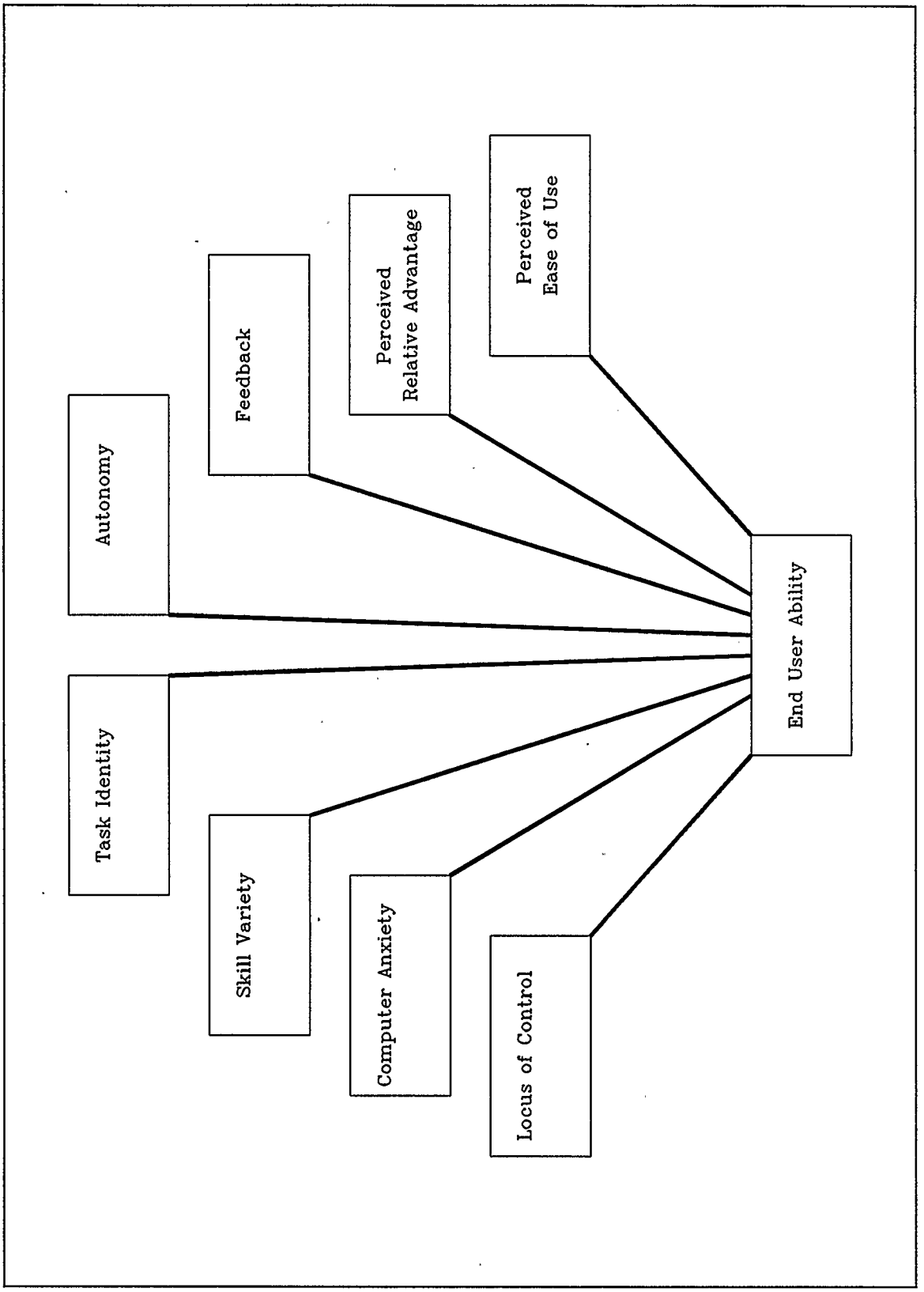
The discussion of learning theory in the previous chapter pointed out several different types of learning which occur. One form of learning which appears to be key in affecting differences in the way individuals learn other tasks is the formation of beliefs and attitudes. In the context of the current research question variables were selected which would explain the differences between high and low ability end users. The independent variables selected for this study are locus of control, computer anxiety, perceived job characteristics, perceived relative advantage, and perceived ease of use. These individual perceptions and beliefs were selected due to the likelihood of their effect on the development of user ability. The model in Figure 2 depicts the relationships between the selected independent and dependent variables. The following discussion will explain each of these constructs more fully and why each was selected for study.

4.1 LOCUS OF CONTROL

The locus of control construct was developed from social learning theory. Rotter (1954) described social learning theory using the following general formula:

$$NP = f(FM \ \& \ NV)$$

Figure 2 End User Ability Model



which reads as: the potentiality of a set of behaviours occurring which satisfy a specific need (need potential) is a "function of both the expectancies that these behaviors will lead to these reinforcements (freedom of movement) and the strength or value of these reinforcements (need value)". Freedom of movement represents the perceived probability that the expected reinforcements will be received.

Locus of control is concerned with the individual's perception of whether the control over causing the expected reinforcement is internal or external to the individual (Lefcourt, 1976). As a personality construct it describes differences between individual personal beliefs. Phares (1976) describes it as the "extent to which people believe expected reinforcements to their behaviour are controlled by themselves or are contingent on factors they cannot control." When a subject perceives a reinforcement as following his behaviour but not entirely contingent upon that behaviour, the perception is labelled a "belief in external control". However, if he believes the reinforcement to be contingent upon his action it is called "a belief in internal control" (Rotter, 1966).

Locus of control is believed to affect a wide range of behaviours. Heaven (1988) observed that externality appeared to correlate with less desirable traits such as hostility and failure, while internality tended to correlate with assertiveness and achievement motivation. This concurs with observations made by Lefcourt (1976) and Phares (1976). People who perceive their reinforcements to be externally controlled tend to have greater difficulty in learning. In the learning process internals seek out and acquire more information and use it more effectively, particularly in tasks requiring skill. It is difficult for individuals who believe they have little control over life's satisfactions and misfortunes to exert the effort necessary to achieve future goals. "Where people feel they control the situation, they are more likely to exhibit perceptual behaviour that will enable them to cope with potentially

threatening situations than are subjects who feel that chance or other uncontrollable forces determine whether their behaviour will be successful" (Phares, 1976). Locus of control is however, a learned state and can be altered (Good and Brophy, 1986). This change is accomplished through experiences which make the reinforcing outcomes of their behaviour contingent upon themselves (Lefcourt, 1976; Phares, 1976).

The locus of control construct has been used within MIS research on several occasions. Two studies have used it as an independent variable with computer anxiety. Unfortunately, the studies reached different conclusions. Howard and Smith (1986) concluded it was not significantly correlated to computer anxiety, however, Igbaria and Parasuraman (1989) found that it was a significant correlate. Another study unrelated to computer anxiety used attitudes toward computers as a dependent variable. This study performed by Coovert and Goldstein (1980) concluded that internal subjects have a more positive attitude toward computers than externals.

So what does all this mean in relation to computer ability? It means that locus of control should have an impact on the learning process, the goal of which is the development of behavioral potential/ability. From the previous discussion it is possible to speculate that end users who perceive their reinforcements, from interacting with the computer, to be under their own control will attempt to acquire more information, try new approaches and be more motivated to learn, whereas their counterparts who perceive their reinforcements to be beyond their control will find their interaction defeating, unmotivating and their learning process will be slow at best. This leads to the following hypotheses concerning locus of control:

1.1 There is a significant correlation between locus of control and end user ability.

1.2 There is a significant difference in the mean level of locus of control between high and low ability end users.

4.2 COMPUTER ANXIETY

Anxiety is a "generalized emotional distress" (Nietzel, Bernstein and Russell, 1988) experienced by an individual. Anxieties are generally divided into two categories which are trait (manifest) or state anxieties. Manifest anxiety reflects an individual's chronic sense of being nervous and anxious, whereas, state anxiety is a "transitory response to a specific situation" (Lindzey, Hall and Thompson, 1975). Igbaria and Parasuraman (1989) and Howard and Smith (1986) both measured manifest anxiety in their studies. Neither found a significant relationship between manifest anxiety and computer anxiety.

Computer anxiety is a form of state anxiety. It is an irrational emotional distress which is experienced by an individual when using or considering use of a computer. It is also a learned response. According to Phares (1976), anxiety is indicative of a context where the individual has "a high expectancy for punishment or a low expectancy of success" in an area of valued need. Anxieties develop from an inability to experience success in interactions with computers (Bloom, 1985). The result is that the learning process involved in developing computer ability can be severely inhibited (Gilroy and Desai, 1986), as well as reducing the duration and frequency of use, the level of sophistication and the diversity of applications used (Igbaria, Pavri and Huff, 1989). Additional studies have shown that computer anxiety can be improved. These studies suggest that through carefully selecting software or situations, subjects who experience anxiety can encounter positive reinforcement and control over their computer interactions (Bloom, 1985; Hill, Smith and Mann, 1987; Nietzel, Bernstein and Russell, 1988; Smith, 1989).

Computer anxiety has often been used as a dependent variable in MIS research. One exception to this trend is a study by Igbaria, Pavri and Huff (1989). This project investigated the relationship between computer anxiety and user sophistication. The researchers found a significant inverse correlation between computer anxiety and sophistication. This indicates that end users who experience computer anxiety tend not to be very sophisticated users. In the study by Ibgaria, Pavri and Huff (1989) sophisticated users were defined as users who had a high level of expertise in a wide variety of application categories. The following hypotheses have been developed concerning computer anxiety:

2.1 There is a significant correlation between computer anxiety and end user ability.

2.2 There is a significant difference in the mean level of computer anxiety between high and low ability end users.

4.3 JOB CHARACTERISTICS

Perceived job characteristics are an individual's perception of their own job environment. How a person sees their job influences their attitudes toward the job and their motivation and satisfaction in relation to it. Jobs which provide high motivating potential have more occasions for self reinforcement for individuals capable of performing the job. In cases where the individual is not capable, motivating potential will be lower (Hackman and Suttle, 1977). In this latter case, people will tend to give up rather than to continue failing or continue experiencing the frustrations of the job activity.

Based upon Bandura's concept of reciprocal interaction (Hergenhahn, 1988) an individual's beliefs about his job has an impact on activities in his job such as computer learning. In this context the computer is part of the person's job. Not only will his perception of his job's characteristics affect job performance and satisfaction but it will also

impact on computer learning. Since tasks performed with the computer are not done in isolation from the job, each has an impact upon the other.

The job characteristics which will be utilized in this study are autonomy, task identity, skill variety, and job feedback. The following are the construct definitions as provided by Hackman and Oldham (1980):

> Autonomy is "the degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out".
>
> Task identity is "the degree to which a job requires completion of a whole and identifiable piece or work, that is, doing a job from beginning to end with a visible outcome".
>
> Skill variety is "the degree to which a job requires a variety of different activities in carrying out the work, involving the use of a number of different skills and talents of the person".
>
> Feedback is "the degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance".

Cheney (1984) found a significant relationship between autonomy and programmer productivity in his study. Although Cheney's study used programmers, it is reasonable to expect that though programmers' perceptions of their jobs may differ from non programmers, their reactions to these perceptions should be consistent. This study will verify whether autonomy will correlate with end user ability in a similar fashion.

Ghani and Al-Meer (1989) also found that an end user performing a job with high task scope will be more satisfied in the use of a micro computer. They stated that a high scope job is one which involves a greater variety of skills, whole pieces of work, direct feedback, and greater autonomy. They felt that using a computer in a job with high task scope allows the individual in that job to explore new ways of doing existing tasks and of experiencing personal development, resulting in a greater sense of self accomplishment. This

conclusion is echoed by Brass (1985) who states that "autonomy and skill variety are necessary in order to perform well" when the job encounters technological uncertainty.

Generally speaking, end user tasks involve higher levels of technological uncertainty. Technological uncertainty refers to the level of predictability in transforming inputs to outputs. Griffin, Welsh and Moorhead (1981) observed in their literature review that work performance levels are higher for jobs which are perceived as having high task scope. However, an earlier study performed by Griffin (1980) failed to substantiate that conclusion. He believed that this was a result of the study design rather than the hypothesis itself. In a separate study Yaverbaum (1988) made the observation that some workers do not perceive their jobs as more meaningful after the introduction of a computer.

What does all this mean in relation to end user ability? The purpose of this study is not to determine causation but to ascertain whether a relationship exists between these perceived job characteristics and end user ability. As was noted from social learning theory and Bandura's concept of reciprocal interaction each can be influencing the other. In the case of the computer end user, the development of ability takes place in the context of the work environment. The employee's perception of this environment will be modified by his experience within the job. Two possible conditions are that the development of an individual's computer ability, or lack of, may influence his perception of the job or else his perception of the job may influence the development of his ability. The following hypotheses are made:

3.1 There is a significant correlation between the skill variety in a job and end user ability.

3.2 There is a significant difference in the mean level of skill variety in a job between high and low ability end users.

3.3 There is a significant correlation between task identity and end user ability.

3.4 There is a significant difference in the mean level of task identity between high and low ability end users.

3.5 There is a significant correlation between job autonomy and end user ability.

3.6 There is a significant difference in the mean level of job autonomy between high and low ability end users.

3.7 There is a significant correlation between job feedback and end user ability.

3.8 There is a significant difference in the mean level of job feedback between high and low ability end users.

4.4 RELATIVE ADVANTAGE

Relative advantage is "the degree to which using an innovation is perceived as being better than using its precursor" (Moore, 1989). This definition is based on one presented by Rogers (1983). The difference rests on a point raised by Ajzen and Fishbein (1980) that one's perception of using an innovation may differ from one's perception of the innovation itself (Moore, 1989). Davis (1989) developed a similar construct called perceived usefulness. It was defined as "the degree to which a person believes that using a particular system would enhance his or her job performance". In essence, what this construct means is that the more advantageous an individual perceives what he is doing, over what he did before, the more likely he is to continue. This construct is applicable to end user computing because people will "tend to use or not use an application to the extent they believe it will help them perform their job better" Davis (1989). According to Rogers and Shoemaker (1971) the relative advantage construct represents the "intensity of the reward or punishment resulting from adoption of an innovation". This concurs with Davis' observation that a user will gauge the degree of benefit for the effort he will put into learning a new system or new ways of performing tasks. This is the basis by which perceived relative advantage impacts computer

ability. Individuals who perceive the computer as an innovation which is not advantageous will not expend the effort necessary to develop their ability, whereas those who see it as advantageous will. The following hypotheses were developed:

4.1 There is a significant correlation between perceived relative advantage and end user ability.

4.2 There is a significant difference in the mean level of perceived relative advantage between high and low ability end users.

4.5 EASE OF USE

Perceived ease of use is "the degree to which an innovation is easy to understand and use" Moore (1989). This definition is very similar to Davis' (1989) ease of use construct which was defined as "the degree to which a person believes that using a particular system would be free of effort". The less complex an application is perceived as being, the more likely it is to be accepted. It is recognized that an individual's perception of ease of use will be dependant on the software they have used. That is, those utilizing easy to use packages will likely see computers as less complex than those starting with difficult application software. However, this is precisely what the perceived ease of use construct is to account for. These beliefs will have formed from the varieties of software previously used and through additional learning from interaction with environmental factors, i.e., other users, publications, etc. Research by Davis (1989) and Davis, Bagozzi and Warshaw (1989) has shown that perceived ease of use is correlated to actual use. In addition, Rogers and Shoemaker (1971) point out that innovations which require more learning to acquire ability are less likely to be accepted. Perceived ease of use therefore will function as a determinant of end user ability. The amount of effort the individual perceives as necessary in learning is directly related to how complex he perceives the innovation to be. The following hypotheses were developed:

5.1 There is a significant correlation between perceived ease of use and end user ability.

5.2 There is a significant difference in the mean level of perceived ease of use between high and low ability end users.

Table 1 Summary of Hypotheses

1.1	There is a significant correlation between locus of control and end user ability.
1.2	There is a significant difference in the mean level of locus of control between high and low ability end users.
2.1	There is a significant correlation between computer anxiety and end user ability.
2.2	There is a significant difference in the mean level of computer anxiety between high and low ability end users.
3.1	There is a significant correlation between the skill variety in a job and end user ability.
3.2	There is a significant difference in the mean level of skill variety in a job between high and low ability end users.
3.3	There is a significant correlation between task identity and end user ability.
3.4	There is a significant difference in the mean level of task identity between high and low ability end users.
3.5	There is a significant correlation between job autonomy and end user ability.
3.6	There is a significant difference in the mean level of job autonomy between high and low ability end users.
3.7	There is a significant correlation between job feedback and end user ability.
3.8	There is a significant difference in the mean level of job feedback between high and low ability end users.

Table 1 (Cont.) Summary of Hypotheses

4.1	There is a significant correlation between perceived relative advantage and end user ability.
4.2	There is a significant difference in the mean level of perceived relative advantage between high and low ability end users.
5.1	There is a significant correlation between perceived ease of use and end user ability.
5.2	There is a significant difference in the mean level of perceived ease of use between high and low ability end users.

CHAPTER FIVE

RESEARCH DESIGN AND METHODOLOGY

This study looks at the environmental and personality variables described in the previous chapter. The decision to limit the study to these variables was made for operational reasons, which were: 1) the length of time to complete the required instruments; and 2) the willingness of the subjects to commit to the required time for completing the questionnaire. A field study was selected because it is possible to generalize the knowledge obtained about ability across the population of end users.

The goal of this study is not to validate the theories described in chapter three, but to explore the relationships which may exist between end user ability and the selected independent variables. These relationships will be studied based on the hypotheses which have been developed from the theories presented. The selected variables are shown in Table 2 along with the source of the instruments used in measuring each of the constructs.

5.1 DESIGN CLASSIFICATION

Emory (1985) has described a classification scheme which helps define the characteristics of research projects. In keeping with this scheme this study is classified as a formal cross-sectional field survey. The study uses statistical analyses to provide a descriptive

Table 2 Variables and Instrument Sources

VARIABLE	INSTRUMENT BY
Locus of Control	Valecha and Ostrom (1974)
Computer Anxiety	Raub (1982)
Job Characteristics	Sims, Szilagyi and Keller (1976)
Perceived Usefulness	Moore (1989)
Perceived Ease of Use	Moore (1989)
End User Ability	Cheney and Nelson (1988)

evaluation of the ex post facto variables involved. The end users were measured in their normal environmental conditions. The users' behaviour and perceptions of ability may change if they are measured somewhere other than in their local environment.

5.2 SAMPLE IDENTIFICATION

5.2.1 Subjects

The people selected to participate in this study are end users of computerized information systems. But what exactly is an end user? The definitions of an end user cover a wide spectrum. Rockart and Flannery (1989) classified end users into a number of different types. The classifications they developed are:

DP Programmers: Program in end user languages.

End User Computing Support Personnel: Are located in a central support organization such as an information centre.

Functional Support Personnel: Programmers who support other end users within their particular functional area.

End User Programmers: Use both command and procedural languages directly for their own personal information needs.

Command Level Users: Perform simple inquiries often with a few simple calculations and generate unique reports for their own purposes.

> Nonprogramming End Users: only access computer stored data through software provided by others.

This classification scheme encompasses everyone from the rank amateur to the professional system designer and programmer. Carr (1988) presents a similarly comprehensive range when he defines end users as "individuals who are willing to use computer resources to get their job done". This statement appears to include anyone who uses a computer as part of their job. These definitions provide a rather broad range of potential participants. Panko (1988) disagreed with Rockart and Flannery by stating he believes the first two classifications represent systems professionals and should not be included as end users. Yaverbaum (1988) essentially agrees with Panko, however, she excludes functional support personnel. She saw end users as any member of an organization who interacts with computer systems, but who is not employed as a programmer or systems analyst. For the purposes of this study the following definition of end users is proposed, which is developed from Panko (1988) and Moore (1987):

> END USERS: Are individuals who are not systems professionals and who make direct use of a computer in the performance of their job.

This definition is intended to include anyone employed as a functional support person. It also includes people who perform modelling, data queries, graphics, spreadsheet analyses, wordprocessing, etc. as part of their jobs.

5.2.2 Sample Selection

"A population is ... the total collection of people, things, or events under consideration; it is whatever group the investigator wishes to make inferences about" (Neale and Liebert, 1986). The population selected for this study are those end users who use a computer in the performance of their job but who are not computer professionals.

It is important for any sample selected from the population to be representative of it. In this study, difficulty exists in that the population is spread out over a large number of organizations and geographic locations. As a result, a convenience sample was made of eight companies representing different economic sectors. These companies were contacted and their participation requested. Of these, three agreed to participate in the study. Sectors represented by these businesses are banking, utilities and charities. Although this selection process is not random, it does reduce potential bias from using a single company or sector. In addition, it will improve the ability to generalize the results across the population, as well as reduce the strain upon a single company for data collection.

Due to the current economic conditions the participating companies requested their participation be minimized as much as possible. In addition, none of the companies could provide a listing of their end users. Consequently, the sample was obtained through a census of end users in departments within these organizations. One exception to this is the charitable organization. This business was small enough for all the employees of the organization to participate. Approximately the same number of subjects were selected from each of the companies.

Specific departments were identified based on the manager's willingness to participate and the department's representation of different user groups in the population. In addition, attempts were made to have the departments represent a variety of business areas. Areas represented in the study are general operations, accounting, marketing, human resources, engineering and senior management. Managers assisted in identifying the end users within their own departments.

5.2.3 Sample Size

Sample size is determined in advance in order to provide a desired level of precision for the study (McClave and Dietrich, 1988). Statistical formulae are available for making this determination, however, it is necessary to first obtain a reasonable estimate of the population variance. For this study, a reasonable estimate of this variance was not available. As a result, a review of current literature was made to determine an appropriate sample size.

There are a wide range of sample sizes used in MIS research. For this study, primary consideration was given to ensuring the sample was large enough to provide adequate power for statistical results. This necessity is emphasized by Baroudi and Orlikowski (1989). Another consideration was to obtain an adequate representation of the population in order to minimize bias. A minimum useable sample size of 200 was selected. This size met additional criteria mentioned by Tabachnick and Fidell (1989) for regression analysis. They state that for hierarchical regressions there be "20 times more cases than" independent variables. In this study their are eight independent variables, therefore a sample size of 160 would suffice.

5.3 QUESTIONNAIRE DEVELOPMENT

The field study to be described is based upon individual self report for data collection. Research performed by Shrauger and Osberg (1981) indicates that "there seems to be substantial support for the notion that self-assessors ... make as effective judgments about their own behaviour as can be made by any other means." Since the constructs to be measured are individual perceptions the only practical method of measurement for a sample of this size is self report. Use of self reporting will also help alleviate corporate concerns regarding time invested in the study. Each of the constructs were operationalized by having

the subjects respond to statements, which are representative of the construct domain, by indicating to what extent they identified with the statement.

5.3.1 Instrument Selection

5.3.1.1 Independent Variables

Locus of Control

The instrument used to measure this construct is Valecha and Ostrom's (1974) short form of Rotter's (1966) locus of control instrument. The short form was tested for validity by Valecha and Ostrom. A Cronbach (1951) reliability alpha of 0.77 was reported by Igbaria and Parasuraman (1989) for this scale. The individual questions are scored between 1 and 4 in the direction of increasing externality. The scores for all the items are then summed to obtain an aggregate score for locus of control. The possible range of the scores is between 11 and 44.

Computer Anxiety

This construct was measured using Raub's (1982) computer anxiety scale. Reliability alpha of 0.85 and 0.94 were reported by Howard and Smith (1986) and Igbaria and Parasuraman (1989) respectively. The questions are scored between 1 and 5 in the direction of increasing computer anxiety. The individual scores are summed to create an overall score for this variable. The range of scores is between 10 and 50.

Job Characteristics

The instrument used to measure job characteristics is the Job Characteristics Inventory (JCI) (Sims, Szilagyi and Keller, 1976). This instrument was designed based on the Job

Diagnostic Survey developed by Hackman and Oldham (1975). The JCI scale was tested for validity and reliability. The job characteristics of interest are skill variety, autonomy, feedback and task identity. Reliability alpha reported for each characteristic are 0.82, 0.84, 0.86, and 0.83 respectively (Sims, Szilagyi and Keller, 1976). Although the Job Diagnostic Survey is used more frequently in MIS research, the JCI scale was selected due its higher reliability (Pierce and Dunham, 1978) (Table 3). Each characteristic is scored as a sum of

Table 3 Comparison of Reliability Alpha for the Job Characteristics Inventory and the Job Diagnostic Survey

Characteristic	JCI	JDS
Skill Variety	0.82	.0.71
Autonomy	0.84	0.66
Feedback	0.86	0.71
Task Identity	0.83	0.59

several individual items on a scale of 1 to 5. The overall range of scores varies with each characteristic due to the number of items used for their measurement.

Relative Advantage

The instrument used is Moore's (1989) measure of relative advantage. The scale has been tested for validity and reliability. Moore reports obtaining a reliability alpha of 0.97. The instrument uses a seven point Likert scale for each question and is scored in the direction of increased advantage. There are nine items in the scale and the range of possible scores is between 9 and 63.

Ease of Use

Moore's (1989) ease of use instrument was used to measure this construct. This scale has also been tested for validity and reliability. Moore reports obtaining a reliability alpha of 0.91. The instrument is made up of eight items and is scored in the direction of increased ease of use. This scale uses a seven point Likert scale. The range of scores will be between 8 and 56.

5.3.1.2 Dependent Variable

End User Ability

A detailed literature search was performed to locate potential instruments for measurement of this construct. From this search only three useful instruments were located. None of these instruments were thoroughly validated. The only instrument reporting validation efforts was the one developed by Cheney and Nelson (1988). Construct validation and content validation were performed during development of the instrument, however, Cheney and Nelson did not perform predictive validation. Due to the lack of thoroughly validated instruments the decision was made to use Cheney and Nelson's instrument and to modify it according to their recommendations. This instrument is a self report of ability. The subjects are asked to respond to questions about their ability in each of 11 skill areas. The range of score for the instrument is between 11 and 44. This instrument was used in a study by Nelson and Cheney (1989) where they reported a reliability coefficient of 0.803. They determined this alpha score by using the Cronbach alpha test.

In their paper Cheney and Nelson (1988) suggest three improvements that could be made to their instrument. The first is to clarify item number eleven, which reads as 'Understand and Interpret Output'. This was accomplished in this study by rephrasing the

item to read 'Understand and Interpret Display Screens and Reports'. The second improvement is item number seven, which reads 'Handle Data Communications'. This was rephrased by altering it to read 'Establish Data Communications (i.e., set baud, parity, etc. on Kermit, Procomm and other packages)'. These changes are shown in Table 4. The third

Table 4 Modifications to the Ability Instrument

As originally stated by Cheney and Nelson	
Item:	
7.	Handle Data Communications
11.	Understand and Interpret Output
As restated in the current questionnaire	
Item:	
7.	Establish Data Communications (i.e., set baud, parity, etc. on Kermit, Procomm and other packages)
11.	Understand and Interpret Display Screens and Reports

improvement suggested was to reduce the instrument to three factors rather than the eleven current items. This alteration was not made due to its significant impact on the scale and the consequent need for revalidating the instrument. A third modification which was made though, was to change the scale from a five point Likert scale, ranging from Very Low (VL) to Very High (VH) to a four point Likert scale ranging from 1 to 4. This change was based on work by Tsay and Solomon (1987) and Hurt (1990) in which "they used Bloom's taxonomy (Bloom, 1956) to develop a rating scale" (Hurt, 1990). The new four point scale assists subjects by providing definitions for each ability or knowledge level (Table 5). These

Table 5 Ability Level Descriptors

NONE (1=NONE)	I have no knowledge or ability with this subject.
UNDERSTAND BASICS (2=BASICS)	I have an introductory level knowledge about the subject. I understand and am familiar with the basic terms and concepts associated with this topic, and am able to perform simple tasks correctly.
FUNCTIONAL WORKING KNOWLEDGE (3=FWK)	I can apply the principal concepts related to the subject in order to analyze and develop solutions for specific problem situations. I can do many straight forward tasks related to the topic, however, for very complex tasks, I need to get help.
EXPERT (4=EXPERT)	I have a thorough, in-depth knowledge of the subject matter. I can identify and develop the best solution in complex situations. I can also clearly and adequately communicate my decisions and reasonings. I can help you with any problem you may have.

descriptions will help the subjects be more consistent in estimating their ability. Although the instrument was not revalidated after these changes, it is believed that these changes resulted in its improvement. The modifications were minor and provided clarification for the issues of concern to Cheney and Nelson.

5.3.2 Questionnaire Design

The selected instruments were combined to create one comprehensive questionnaire. The questionnaire then went through a series of tests to improve the instructions and the design format. Table 6 shows where the individual items from each instrument appear in the questionnaire. The questionnaire followed, as much as possible, the Total Design Method as presented by Dillman (1978). A photographically reduced copy of the questionnaire is

Table 6 Location of Instrument Items in the Questionnaire

INSTRUMENT	QUESTIONNAIRE LOCATION	
Locus of Control	Section IV -	All
Computer Anxiety	Section I -	1 to 5 and 27 to 31
Relative Advantage	Section I -	6, 9, 10, 15, 20, 21, 23, 25, 26
Ease of Use	Section I -	8, 11, 12, 14, 16, 17, 19, 22
Skill Variety	Section III -	1, 5, 8, 11, 15
Autonomy	Section III -	2, 6, 9, 12, 16, 19
Task Identity	Section III -	3, 13, 17, 20
Feedback	Section III -	4, 7, 10, 14, 18
Ability	Section II -	Ability Column

displayed in Appendix A. When complete it was constructed into an 8½ x 11 inch booklet format.

Initially, consideration was given to the length of the questionnaire. Berdie (1973) concluded that the length of a questionnaire is not correlated with response rates. Dillman agrees with this, however, he states further that this only holds true for surveys up to 12 pages, or 125 items. In keeping with these results, the questionnaire used for this study was reduced to 13 pages (96 items) from the 22 pages (123 items) used in "Pilot One" (to be described later in section 5.3.3.1). The Total Design Method makes a variety of recommendations concerning the structure and construction of the questionnaire. These suggestions were also followed as much as possible.

5.3.3 Questionnaire Testing

The following sections will describe the series of pilot studies and pretests the questionnaire went through to ensure that it was a suitable length, the instructions were clear, and that the questions were well ordered. In addition, the tests were used to establish that the data received was compatible with the statistical test to be used. The questionnaire went through several iterations before the final draft was developed.

5.3.3.1 Pilot One

A pilot study was conducted to expose any flaws in the experimental design and implementation. The subjects for this pilot were obtained from four divisions of The Alberta Treasury Department. Although a random selection was desirable it was not possible due to the department's inability to identify all its end users and a desire on their part to minimize their time involvement. It was therefore decided to do a census of each division to include all end users who meet the sample criteria. The managers in each of the divisions were contacted and arrangements were made to complete the questionnaire. Revenue Administration declined to complete the section on peer assessment citing possible morale implications. This method of delivery achieved a 100% completion rate in spite of the 45 minutes required to complete the questionnaire. The divisions from which the subjects were taken are Corporate Tax, Tax Information Services, Credit Unions, and Revenue Administration. They provided a sample size of 20 individuals. These individuals represent a broad spectrum of the end user population in question. However, the sample was distinctly biased since the majority of the subjects were auditors. The questionnaire was administered to the subjects as a group with the questionnaire administrator present.

Peer ranking was used as a means of measuring the dependent variable (Kane and Lawler, 1978; Reilly and Chao, 1982; Shrauger and Osberg, 1981). Peer ranking is considered most successful when members within a group are able to have unique views of each group member's behaviour and the members are capable of perceiving accurately the required behaviour.

Problems which were encountered in doing this pilot study are as follows:

The locus of control scale was confusing;

Instructions within the questionnaire needed to be clearer;

Having all subjects within a work area complete the questionnaire at the same time proved difficult and inconvenient for the participants;

The instrument developed for the dependent variable was inadequate due to lack of validity testing;

The questionnaire took too long to complete (currently 45 minutes on average);

Too many variables were included in the study;

Steps were taken to rectify all of these concerns by reducing the number of variables and improving instructions. Positive affirmations from the pilot study were that the logistics of doing a census worked well and the data received was suitable for the planned analyses.

5.3.3.2 Pretesting

After modifications from the first pilot were completed, three pretests were performed. Each pretest used 10 second year M.B.A. students as subjects. Also, each pretest was conducted after changes were made to the questionnaire used in the previous pretest. Concerns addressed from these pretests are as follows:

Further clarification of instructions;

Obtaining estimates of time to complete;

Improvement of the sequential organization of the instruments;

Improvement of the questionnaire's appearance

Change in presentation of the locus of control instrument;

Removal of filler questions;

Title change for the questionnaire.

On the third pretest, very few modifications were suggested. The determination was then made not to continue pretesting.

5.3.3.3 Pilot Two

Subsequent to the three pretests a second pilot study was performed. The subjects selected were full time first year M.B.A. students. A census was conducted of the students enrolled in the first year financial accounting class. Permission was obtained from the instructor and the questionnaire was distributed in the last half of a lecture. There were 31 subjects who responded, three responses from which were unusable. In relation to the total sample, this represents a completion rate of about 75%. The questionnaire took an average of 20 minutes to complete. Problems noted in this pilot study are as follows:

Some participants felt pressured when they took longer than average, in the group setting;

Concern over the wording of a few questions in the future and past tenses rather than in the present tense.

In response to the first observation the decision was made to distribute the questionnaires individually, rather than as a group. This would reduce the pressure on subjects who take longer to complete the questionnaire. It would also allow all the participants to complete the questionnaire at a more personally convenient time. In response to the second concern, a minor change of wording was made to three questions from the computer anxiety scale and

Table 7 Modifications to the Computer Anxiety Instrument

Original Version	
Instrument Item:	
1.	I am confident that I *could* learn computer skills.
5.	*If* given the opportunity to use a computer, I am afraid that I might damage it in some way.
27.	I *have avoided* computers because they are unfamiliar to me.
Modified Version	
Instrument Item:	
1.	I am confident that I *can* learn computer skills.
5.	*When* given the opportunity to use a computer, I am afraid that I might damage it in some way.
27.	I *avoid* computers because they are unfamiliar to me.

two instruments were replaced (Table 7). The instruments replaced were the ease of use and usefulness scales by Davis, Bagozzi and Warshaw (1989). These two instruments were replaced by two equivalent scales developed by Moore (1989)

5.3.3.4 Pilot Three

After evaluation of the second pilot study and completion of the modifications, a third pilot study was conducted. This pilot study was executed as though it was actual data collection. A company was contacted and their cooperation was obtained for the pilot. A census of three departments was performed. The departments were selected based on their willingness to participate and their representation of the population. The questionnaires were distributed through use of the company's internal mail and were returned to a representative

of the IS department. The company provided a cover letter to be sent with the questionnaire. The subjects were also given an envelope to seal their completed questionnaire in. This method resulted in a response rate of 74%, giving a usable sample size of 100.

There were few problems associated with this pilot study. The only changes made to the questionnaire were a small addition to the introductory letter and a reordering of two questions. The data was suitable for the planned analyses.

5.3.4 Questionnaire Distribution

After identification of the sample group for each company the questionnaire was distributed. Each employer provided a letter which accompanied the questionnaire explaining the purpose of the research study, the employer's cooperation, and the benefits of participation. The questionnaire was delivered using each company's internal mail. Each departmental manager served as a collection point and provided notification when collection was required. Questionnaires were collected one week after distribution, however sometimes there were stragglers. An envelope was provided with the questionnaire to preserve the subjects' confidentiality. According to Dillman (1978) an average response rate of 77 percent should be possible using his Total Design Method. For this study a total of 310 questionnaires were distributed and 264 were collected. This represents an 85% response rate.

5.4 DATA HANDLING AND ANALYSIS

5.4.1 Data Handling

Completed questionnaires were reviewed for errors. Errors were handled in a variety of ways. In cases where the correction of the error was obvious it was corrected. As recommended by Emory (1985) this practice was limited to situations where there is no doubt

what the answer is. A number of other guidelines for handling missing data have been presented by Babbie (1983). He agrees that under some circumstances you may be able to conclude the missing data is one of the appropriate answers. Babbie also states that a middle value may be used to replace missing data, or else to randomly generate values. He indicates that these latter methods are particularly appropriate solutions because they are conservative and work against hypothesized relationships. A last method he suggests is to exclude the responses from the analysis. This method was used when there were a large number of incorrect or missing responses. Babbie cautions that this method should be used judiciously as it can result in sample bias or insufficient sample size.

After being reviewed for accuracy, the questionnaires were coded and the scores entered on a Lotus spreadsheet. Data was entered twice and totals were compared to ensure accuracy. Discrepancies were isolated and corrected.

5.4.2 Data Analysis

Three different statistical analyses were performed using a software package called SPSS-X. A Pearson correlation coefficient, a multiple regression, and an analysis of variance were performed on the data. Although these are parametric analyses and the nature of the data in this study is ordinal, Kerlinger (1964) recommends the use of "parametric tests rather than nonparametric tests" as long as there are no gross departures from the required assumptions.

The Pearson correlation will "measure the strength of the ... relationship between" each combination of two variables (McClave and Dietrich, 1988). This analysis will give an initial indication of significant relationships between the dependent and independent variables. The multiple regression will determine and describe the nature of the significant relationships between the independent variables and the dependent variable. Caution must be used in using

the regression analysis for causal inference in this type of study. As noted by Neale and Liebert (1986) "causal inferences require research designs that can control for plausible rival hypotheses." However Emory (1985) states that frequently ex post facto designs are the only viable research designs. In these cases he suggests that causal explanations between variables be made cautiously. To perform the ANOVA the sample was divided into thirds based on the scores for the dependent variable (ability). The top third and bottom third were then used for the ANOVA. The ANOVA compares the means of independent variable scores for the two groups to determine whether a significant difference exists in the means. These analyses were used to test the hypotheses which have been developed.

CHAPTER SIX

DATA ANALYSIS AND RESULTS

The data collected was initially evaluated for accuracy. Subsequently, the impact of missing data was then weighed and dealt with. The figures were also tested to ascertain whether they conformed to the necessary assumptions for parametric analysis and they were then analyzed. Pearson product-moment correlation and one way analysis of variance (ANOVA) were used as methods to determine whether the data substantiated the hypotheses presented in chapter four. A multiple regression was also performed to determine which variables added significantly to an understanding of end user ability. The following is a discussion of the steps followed and the analytical results obtained.

6.1 DATA PREPARATION

6.1.1 Data Entry

The first step taken was to review the questionnaires for completeness. Then, as mentioned in the previous chapter, the data were entered onto a Lotus 123 spreadsheet. Afterwards, the data was entered a second time. The two data sets were compared to ascertain the accuracy of the data input. Five data entry errors were noted. The original

questionnaires were consulted to obtain the appropriate responses and the corrections were made. The data sets were subsequently compared again to verify their accuracy.

This method of data entry validation was used because it provides a very high level of confidence in the precision of the data set. It utilizes two data files to provide a verification of 100% of the subjects' responses. This technique tends to be more accurate than taking samples of the data set and verifying the sample accuracy. The latter method provides a level of accuracy only as good as the sampling involved.

6.1.2 Missing Data

The decision of how to deal with missing data was described in the previous chapter. The discussion here will elaborate on the types of missing data encountered and specifically how they were resolved. Missing items were coded with the value '99' when entered into the Lotus spreadsheets .

As mentioned earlier, of the 310 questionnaires distributed there were 264 returned. Of those returned only one respondent did not complete the computer ability section, rendering this questionnaire unusable. This left a useful sample size of 263 subjects, however, missing data from other scales reduced this number for some of the individual constructs.

Of the 263 useful respondents four did not complete the locus of control questions. This resulted in a reduction of the useful sample size for this measure to 259. In addition, one individual missed a page of the questionnaire and did not complete more than half of the questions concerning relative advantage and complexity. The decision was made to exclude these scales for this individual also. This resulted in a sample size of 262 for these latter two constructs.

Table 8 Single Questions Missed by Instrument

SCALE	# OF MISSED QUESTIONS
Anxiety	1
Relative Advantage	1
Ease of Use	4
Skill Variety	1
Feedback	3
Locus of Control	1

The next type of missing data encountered were single questions which were unanswered. Eleven of these were located. Since there were no respondents who missed more than one question in a scale, the decision was made to replace each missing item with the mean of the responses for that individual for that scale. This method is recommended by Tabachnick and Fidell (1989) when the subject is determined to be part of the study population. These adjustments were made to the anxiety, relative advantage, ease of use, skill variety, feedback, and locus of control scales. Table 8 shows how many single questions were missed in each of these scales over the entire sample.

6.1.3 Reliability Tests

The reliability of each instrument was calculated using Guttman's Lower Bound (Guttman, 1945). Guttman's method calculates six different lower bounds based on a single study trial. Although a reliability coefficient cannot be determined from only a single trial, it is possible to establish lower bounds for it. Guttman has shown that the reliability coefficient

cannot be smaller than the largest of the six lower bounds calculated. One of the six calculations in this method is the commonly used Cronbach alpha coefficient. In addition, no matter at what level these bounds may be they do not disprove the possibility of the reliability coefficient still being equal to one (Guttman, 1945).

Nunnally (1978) states that an alpha coefficient of .70 or higher is sufficient for basic research. He goes on to state that in the early stages of research, where the size of correlations are of primary interest, effort to increase the reliability of an instrument "beyond .80 is often wasteful of time and funds". However, in applied situations where important decisions are made on the basis of test scores, a minimum alpha coefficient of .90 and preferably .95 is necessary. For the purposes of this study .70 will be sufficient as a minimum coefficient level.

Table 9 Lower Bounds for Reliability

SCALE	GLB
Anxiety	.8467
Relative Advantage	.8881
Ease of Use	.8040
Ability	.8763
Skill Variety	.8799
Autonomy	.7315
Task Identity	.8164
Feedback	.8763
Locus of Control	.7643

The lower bounds for the measurement instruments are summarized in Table 9. As can be seen most of the values for Guttman's Lower Bound are greater than .80. There are two exceptions though, these are autonomy (.7315) and locus of control (.7643). Both of these values are above the minimum of .70 recommended by Nunnally, therefore these scales are adequately reliable for use in this study.

6.2 TESTING OF ASSUMPTIONS

The data set was tested to determine whether the sample met assumptions regarding outliers, normality, linearity, homoscedasticity, multicollinearity and singularity. These tests were conducted using a statistical software package called SPSS-X version 2.1.

Table 10 Univariate Outliers

	CASE NUMBER	Z[1] SCORE	RAW SCORE	MODIFIED SCORE
Relative Advantage				
	70	-4.29	19	30
	255	-3.68	24	30
Autonomy				
	3	-4.12	8	11
Task Identity				
	3	-4.41	4	7
	61	-3.73	6	7
	209	-3.73	6	7

1) criterion of 3.67 (2 tailed) p = .001

6.2.1 Outliers

Univariate and multivariate outliers were sought through use of z scores and Mahalanobis distances. Six univariate outliers were located (Table 10). They were identified from their z scores which exceeded the p = .001 criterion of 3.67 (2 tailed). The questionnaires for these cases were consulted to determine if an error might still exist in the data entry. No such errors were found. Since these cases do fall within the desired population, the decision was made to reduce the influence of these outliers by modifying their scores to a less extreme value (Tabachnick and Fidell, 1989). The modified scores are shown as well in Table 10. Using a Mahalanobis distance criterion significant at p = .001 there were no multivariate outliers found. The means, standard deviations and ranges for the variables (after adjusting for outliers) are listed in Table 11.

Table 11 Descriptive Statistics

VARIABLE	MEAN	STD DEV	RANGE MIN	MAX
Anxiety	18.4	6.3	10	41
Relative Advantage	54.6	8.1	30	63
Ease of Use	42.9	7.5	20	56
Ability	22.8	6.5	11	44
Skill Variety	16.2	4.2	5	25
Task Identity	16.9	2.8	7	20
Autonomy	23.9	3.8	11	30
Feedback	16.0	4.4	5	25
Locus	23.6	4.7	12	41

6.2.2 Normality and Linearity

Normality was evaluated by measuring the degree of skewness and kurtosis in the data set. The results indicated the data is reasonably normal in its distribution. The assumption of linearity was also found to hold from the evaluation of plotted residuals.

6.2.3 Multicollinearity and Singularity

Multicollinearity was tested for using two methods. The first was an evaluation of the variable correlations and the second was an analysis of the tolerances. Singularity does not exist between the variables. Tabachnick and Fidell (1989) state that multicollinearity exists when two variables have a correlation of .90 or higher. As shown in Table 12 there were no variables with a correlation higher than -.61. Tolerances were all within acceptable ranges (Table 13). Therefore, the data set does not suffer from multicollinearity.

Table 12 Correlations Between Independent Variables

Anxiety	1.00							
Relative Adv.	-.34	1.00						
Ease of Use	-.61	.59	1.00					
Skill Variety	-.19	-.05*	.02*	1.00				
Task Identity	-.10*	.06*	.15	.15	1.00			
Autonomy	-.07*	.02*	.09*	.25	.57	1.00		
Feedback	-.10*	.16	.11*	.21	.23	.24	1.00	
Locus of Control	.20	-.06*	-.10*	-.19	-.06*	-.01*	-.07*	1.00
	Anx	Rel	Eou	Skill	Task	Auton	Feed	Locus

* = not significant at p = .025 (2 tailed)

Table 13 Variable Tolerances

VARIABLE	TOLERANCE
Computer Anxiety	.582
Relative Advantage	.623
Ease of Use	.448
Skill Variety	.852
Task Identity	.652
Autonomy	.623
Feedback	.878
Locus of Control	.927

Table 14 Correlation Coefficients for Independent Variables

	COMPUTER ABILITY
Anxiety	-.54[1]
Relative Advantage	.26[1]
Ease of Use	.39[1]
Skill Variety	.28[1]
Task Identity	.15[2]
Autonomy	.12[3]
Feedback	.12[3]
Locus	-.09[3]

1: $p <= .001$ (2 tailed)
2: $p <= .025$ (2 tailed)
3: not significant at $p = .025$ (2 tailed)

6.3 ANALYSIS OF RESULTS

The data set was evaluated using Pearson product-moment correlation analysis, one way analysis of variance and multiple regression. These analyses were examined in light of their implications on each of the hypotheses. The Pearson correlation and the analysis of variance will be discussed for each variable and the multiple regression will be presented last in section 6.3.9. The Pearson correlation analysis performed is displayed in Table 14. It was used to determine the degree of relationship between each independent variable and the dependent variable. The analysis of variance was performed to evaluate whether there were significant differences between the means of each variable for high and low ability end users. Finally, the multiple regression was used to determine which variables made the most significant contributions to the determination of end user ability, using the inference that the independent variables do predict end user ability.

6.3.1 Locus of Control

The Pearson correlation for locus of control indicated that hypothesis 1.1, which states that there is a significant correlation between locus of control and end user ability, should be rejected. The correlation is listed in Table 14 and it was not significant at $p = .025$ (2 tailed). Hypothesis 1.2, which states that there is a significant difference in the mean level of locus of control between high and low ability end users, was also rejected. Table 15 displays the results from the ANOVA. The data showed that the difference between the two means was not significant at $p = .05$.

Table 15 ANOVA Results For Locus of Control

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	28.196	1.239	0.267
Residual	176	22.761		
Total	177	22.791		

LEVEL	N	MEAN
Low Ability	87	23.99
High Ability	91	23.19

6.3.2 Computer Anxiety

The findings from the Pearson correlation in Table 14 show a statistically significant correlation of $r = -.54$ ($p <= .001$) between computer anxiety and ability. Hypothesis 2.1 therefore, was not rejected. The results from the ANOVA, displayed in Table 16, show that hypothesis 2.2 must also not be rejected. A statistically significant difference of $F = 79.92$ ($p <= .001$) was found between the group means.

6.3.3 Skill Variety

A significant correlation of $r = .28$ ($p <= .001$) was found between skill variety and ability. This result can be referred to in Table 14. Therefore hypothesis 3.1 was not rejected. Hypothesis 3.2 was also not rejected because the analysis of variance (Table 17) showed a significant difference between the means of the high and low ability end users ($F = 16.13$, $p <= .001$).

Table 16 ANOVA Results For Computer Anxiety

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	2319.65	79.92	0.000
Residual	179	29.026		
Total	180	41.752		

LEVEL	N	MEAN
Low Ability	90	21.75
High Ability	91	14.59

Table 17 ANOVA Results For Skill Variety

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	287.074	16.127	0.000
Residual	179	17.801		
Total	180	19.297		

LEVEL	N	MEAN
Low Ability	90	14.79
High Ability	91	17.31

6.3.4 Task Identity

Task identity, as described in Table 14, had a small but significant correlation with end user ability ($r = .15$, $p <= .025$). Therefore hypothesis 3.3 was not rejected, however,

Table 18 ANOVA Results For Task Identity

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	30.264	3.617	0.059
Residual	179	8.367		
Total	180	8.489		

LEVEL	N	MEAN
Low Ability	90	16.58
High Ability	91	17.40

the analysis of variance shown in Table 18 did not indicate a significant difference between the group means. As a result, hypothesis 3.4 was rejected. The value of $F = 3.617$ was not significant at $p = .05$.

6.3.5 Autonomy

The Pearson correlation did not show a significant correlation between autonomy and computer ability. Hypothesis 3.5 was rejected on the basis of this finding. In addition, the analysis of variance (Table 19) showed a value of $F = 2.186$ which was not significant at $p = .05$. This means there was no significant difference between the mean level of perceived

Table 19 ANOVA Results For Autonomy

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	34.709	2.186	0.141
Residual	179	15.878		
Total	180	15.982		

LEVEL	N	MEAN
Low Ability	90	23.30
High Ability	91	24.18

autonomy by both high and low ability end users. Therefore, hypothesis 3.6 was also rejected.

6.3.6 Feedback

There was no significant correlation between feedback and ability in the analysis displayed in Table 14. Hypothesis 3.7, that there is a significant correlation between perceived job feedback and end user ability, was rejected. The analysis of variance also failed to show a significant difference between the means of high and low ability users. As a result, hypothesis 3.8 was rejected at a $p = .05$ significance level. The ANOVA is displayed in Table 20.

Table 20 ANOVA Results For Feedback

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	60.533	3.063	0.082
Residual	179	19.760		
Total	180	19.987		

LEVEL	N	MEAN
Low Ability	90	15.75
High Ability	91	16.90

6.3.7 Relative Advantage

The variable perceived relative advantage had a statistically significant correlation with end user ability. This relationship can be seen in Table 14 as the value r = .26 ($p <= .001$). This means that hypothesis 4.1 was not rejected. The analysis of variance performed for this variable also found a statistically significant relationship. Hypothesis 4.2 was also not rejected because, as shown in Table 21, the difference in the means between high and low ability end users is significant at $p <= .001$.

6.3.8 Ease of Use

The results of the Pearson correlation for this variable indicated that hypothesis 5.1 should not be rejected. The correlation of r = .39 is statistically significant at $p <= .001$. Table 14 still continues to display the outcomes of the Pearson correlation. Table 22 on the other hand, shows the results of the analysis of variance for this variable. These findings

Table 21 ANOVA Results For Relative Advantage

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	859.176	15.668	0.000
Residual	179	54.836		
Total	180	59.304		

LEVEL	N	MEAN
Low Ability	90	53.47
High Ability	91	57.82

Table 22 ANOVA Results For Ease of Use

SOURCE	DF	MEAN SQUARE	F	SIGNIF OF F
By Level	1	1733.607	37.487	0.000
Residual	179	46.246		
Total	180	55.620		

LEVEL	N	MEAN
Low Ability	90	40.23
High Ability	91	46.42

reveal a significant difference between the means for perceived ease of use for high and low ability end users. On the basis of these results, it was not possible to reject hypothesis 5.2.

6.3.9 Multiple Regression

As previously mentioned, the multiple regression was performed to determine which variables contribute significantly to an understanding of end user ability. The analysis was restricted to those variables which were significantly correlated to ability and had a significant difference in means between high and low ability end users. This means that the only variables included in the regression are computer anxiety, perceived skill variety, perceived relative advantage, and perceived ease of use. The results of the regression (Table 23) showed that anxiety, skill variety and relative advantage contributed to an understanding of ability. As shown, the regression equation explains 33% of the variability in end user ability. This statement is deceptive because a causal relationship has not been proven by this study. Ease of use is not included in the equation because its t-statistic was not significant and its inclusion would actually diminish the value of adjusted r^2. It is likely that this is because ease of use was significantly correlated with both anxiety ($r = -.61$) and relative advantage ($r = .59$) and, as a result, likely contributes little that is not already explained through use of these other two variables.

6.4 SUMMARY

The distribution and collection of the questionnaires achieved an excellent response rate of 85% and there was only one questionnaire returned which could not be used. Missing data was handled by replacing single missing questions with the mean response for that individual for that question. Entire scales that were missing were omitted from the study for

Table 23 Multiple Regression Analysis

ANALYSIS OF VARIANCE

	DF	SUM OF SQUARES	MEAN SQUARE
Regression	3	3456.92741	1152.30914
Residual	253	7219.45392	28.53539

F = 40.38175 SIGNIF F = -.0000

R	.57
R^2	.32
ADJ. R^2	.32
Standard Error	5.34185

VARIABLES IN THE EQUATION

VARIABLE	B	SE B	BETA	T	SIG T
Anxiety	-.47	.059	-.453	-7.990	.0000
Skill Variety	.30	.082	.192	3.645	.0003
Relative Adv.	.10	.045	.121	2.165	.0313
(Constant)	21.34	3.495		6.106	.0000

VARIABLES NOT IN THE EQUATION

VARIABLE	BETA IN	PARTIAL	MIN TOLER	T	SIG T
Ease of Use	.069	.057	.456	.907	.3655

that respondent. The sample data set had a few outliers, of which the scores were altered to less extreme values. The data set also met the required assumptions for the parametric analyses performed.

The statistical analyses resulted in the acceptance of the proposed hypotheses for the variables of computer anxiety, perceived skill variety, perceived relative advantage, and perceived ease of use. There were other hypotheses though, which were rejected based on the

analyses performed. The specifics of which hypotheses were rejected and those that were not are summarized in Table 24.

Table 24 Summary of Hypotheses and Results

	HYPOTHESIS	RESULT
1.1	There is a significant correlation between locus of control and end user ability.	REJECTED
1.2	There is a significant difference in the mean level of locus of control between high and low ability end users.	REJECTED
2.1	There is a significant correlation between computer anxiety and end user ability.	NOT REJECTED
2.2	There is a significant difference in the mean level of computer anxiety between high and low ability end users.	NOT REJECTED
3.1	There is a significant correlation between the skill variety in a job and end user ability.	NOT REJECTED
3.2	There is a significant difference in the mean level of skill variety in a job between high and low ability end users.	NOT REJECTED
3.3	There is a significant correlation between task identity and end user ability.	NOT REJECTED
3.4	There is a significant difference in the mean level of task identity between high and low ability end users.	REJECTED
3.5	There is a significant correlation between job autonomy and end user ability.	REJECTED
3.6	There is a significant difference in the mean level of job autonomy between high and low ability end users.	REJECTED
3.7	There is a significant correlation between job feedback and end user ability.	REJECTED
3.8	There is a significant difference in the mean level of job feedback between high and low ability end users.	REJECTED

Table 24 (Cont.) Summary of Hypotheses and Results

	HYPOTHESIS	RESULT
4.1	There is a significant correlation between perceived relative advantage and end user ability.	NOT REJECTED
4.2	There is a significant difference in the mean level of perceived relative advantage between high and low ability end users.	NOT REJECTED
5.1	There is a significant correlation between perceived ease of use and end user ability.	NOT REJECTED
5.2	There is a significant difference in the mean level of perceived ease of use between high and low ability end users.	NOT REJECTED

CHAPTER SEVEN

DISCUSSION, LIMITATIONS AND FURTHER RESEARCH

As mentioned earlier in Chapter Two, little research has been done to date concerning the dependant variable, end user ability, used in this study. The findings of this project contribute to a better understanding of a few of the variables which interact with end user ability. Whether or not the stated hypotheses were rejected, the results of this study make a contribution to our further knowledge.

7.1 DISCUSSION

The study indicated that there is a strong relationship between computer related anxiety and lack of ability among end users. This follows the pattern expected from the discussion of social learning theory. Although causation can not be shown, the results are consistent with what would be expected from the theory. To a large extent this study confirms what to many seems obvious. The contribution made here is that this project confirms this relationship in the MIS field, with ability used as a dependent variable. This study also appears to confirm results obtained by Igbaria, Pavri and Huff (1989) when they found a significant inverse relationship between anxiety and user sophistication. The

sophistication construct they used is similar to ability, although it is measured using a different scale.

Perceived relative advantage and perceived ease of use are additional constructs which appear to have an association with user ability. Although ease of use has a strong relationship with ability the multiple regression shows that this variable does not make a significant contribution to our explanation of ability when anxiety, skill variety and relative advantage are already being used. As mentioned in the previous chapter, it is likely that ease of use becomes superfluous due to its significant correlations with both computer anxiety and relative advantage. It is helpful though, to know that end users low in ability perceive computers as providing little advantage over current methods of performing tasks and that they also perceive computers as not easy to use.

One job characteristic also contributed to an understanding of user ability. This characteristic was perceived skill variety. This characteristic indicated that high ability end users also perceive their jobs as higher in skill variety. Conversely, low ability users perceive their jobs to be lower in skill variety. This result confirms an observation made by Yaverbaum (1988) that a technological innovation does not necessarily result in employees seeing their jobs as more meaningful.

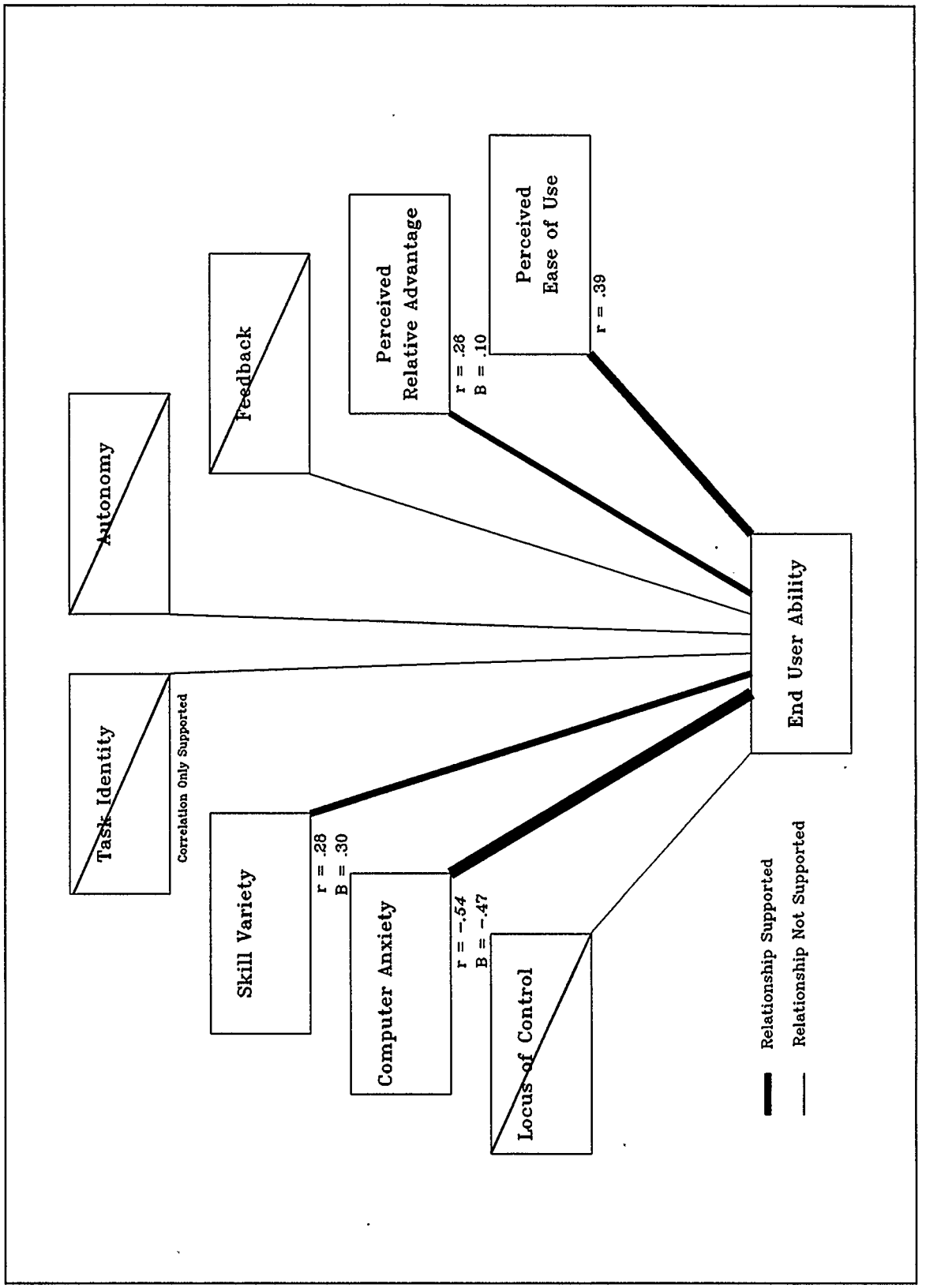
The other three job characteristics studied were task identity, autonomy and feedback. With the exception of task identity, none of these characteristics were significantly related to computer ability nor were their means significantly different between high and low ability users. Task identity however, did have a low positive correlation to ability. The correlation is low and the relationship is quit minor. It is apparent that these three job characteristics do not influence end user ability. It is also likely that computer ability does not have a significant impact of these job perceptions. These are two possible conclusions which can be

drawn, since this study cannot explain the direction of causation. There may also be other explanations, but it seems clear that these three variables do not contribute to nor influence the process of learning which develops end user ability. This leaves them as poor candidates for further research.

The last variable studied, locus of control, has neither a significant relationship with user ability nor a significant difference in means between user groups. This means that the perceived level of control an individual feels they have over their reinforcements does not relate to their ability. This does not mean that use of the construct was entirely useless. The study does support a conclusion reached by Igbaria and Parasuraman (1989) that locus of control is a significant correlate of computer anxiety (Table 6.5).

What has been accomplished by this study? This study has succeeded in answering the research questions presented in Chapter One. The study has revealed (and has confirmed) information about the perceptions and beliefs of high and low ability end users. In addition, other variables have been successfully weeded out. The study has shown that high ability end users are characterized by low computer anxiety, a higher perception of the computer's relative advantage over other ways of task completion, and a higher perception of the skill variety required in their jobs. Low ability end users tend to be the inverse. The results from the study have also shown that the ease of use construct is a significant positive correlate of ability and that there are significant differences in the mean levels of this perception between high and low ability users. However, the results have also shown that this construct has little to contribute when relative advantage and anxiety are included in the analysis. The impact of the results on the End User Ability Model are displayed in Figure 3.

Figure 3 End User Ability Model With Results



7.2 MANAGEMENT IMPLICATIONS

What do these results indicate for management in improving the effective utilization of end user computing? There are several implications which come from this study. To begin with management must be aware of those employees who experience high levels of computer related anxiety. This form of anxiety is not a permanent unchanging characteristic of the individual; it can be altered through adequate training provided at the user's level of ability. It is important in training courses that the user's initial experiences reinforce success in a friendly non-threatening manner (Galagan, 1983). To thrust employees, who exhibit anxiety towards using computers, directly into using them can reinforce their anxiety and severely limit the development of their ability.

A second point for managers is that the users of the information system must perceive it to be more beneficial than their previous method of task completion. This can be accomplished through dissemination of information in publications or through the grapevine. The use of peers has been found to be the most effective and widely used communication channel for adopters of new innovations (Brancheau and Wetherbe, 1989). A point which must be kept in mind by management is that if a system is not really useful or is not perceived by the users as useful, it should not be implemented because it will not be used effectively. Either its usage will be low or else the users will not be inclined to developing their ability to use the innovation. "Users may be willing to tolerate a difficult interface in order to access" a system they perceive as useful, however, ease of use will not compensate for a system that the users perceive no advantages to using (Davis, Bagozzi and Warshaw, 1989).

It is also important for managers, when introducing innovations to their end users, to be aware of implications on the variety of skills required to do the job. Systems which reduce

the employee's perception of the skill variety required for their job will not be effectively utilized. Another possibility though, is to redesign the employees job so that the perceived skill reduction is compensated for.

Although there were variables which did not provide useful relationships with computer ability, they should not all be ignored. Locus of control in particular is one of these. Managers need to be aware that even though this characteristic is not related to ability other research has shown it to be related to usage and to computer anxiety. This study has not contradicted those results. Locus of control still remains a characteristic of the user which influences levels of computer anxiety and actual use of an information system. This characteristic is managed in much the same way as computer anxiety. The user will benefit from experiencing positive interactions with a computer where he perceives himself to be in control of the reinforcements being received.

7.3 LIMITATIONS

Although it is tempting to infer a causal relationship between the independent variables studied and end user ability, it must be cautioned against. Different explanations are possible for all of the variables reviewed. This is a crucial point; the results do not provide any more reason to conclude that perceived skill variety causes development of end user ability than that ability causes differences in the perception of skill variety in a job. Though a multiple regression was performed, its purpose was not to support causation but rather to identify variables not contributing significantly to an understanding of user ability.

A second limitation to this study is its generalization to the population. Every effort was made to obtain a representative sample, however, it is still possible that the sample was biased. Since essentially each company and department was self selected, it is possible for

existing cultural bias in the participating departments to have crept into the study. This may exist even though efforts were made to minimize this situation by obtaining departments which represented different functional areas and companies which represent different sectors of the economy. The companies only represent three different sectors and all are geographically local.

7.4 FUTURE RESEARCH

There are a multitude of additional questions which arise from a study of this type. It is only possible to address a few of the most significant coming out of this research project. One significant point is the contribution made in identifying what not to research in the future. The results of this study suggest that it may not be fruitful to research variables such as locus of control, task identity, autonomy, and feedback in relation to end user ability in the future. There are a number of other variables which have been identified as valuable for the future.

Probably the most useful direction for the future research is to perform controlled experiments using these variables. The purpose would be to identify the direction of causation. Until causation is established we will not know for certain whether the independent variables in this study do in fact predict ability or whether it is vice versa.

Another valuable direction for the future is for further work to be done in improving and revalidating the computer ability instrument. Even with the limitations and potential threats that self report measures present to a study, these types of measures do still provide an important contribution to field research by allowing them to cross multiple systems and software applications.

7.5 SUMMARY

The research project has provided a meaningful contribution to the understanding of end users and their computer related ability. Four of the eight independent variables showed a significant relationship with end user ability, although one of these does not contribute a great deal to an explanation of ability when the other three are used. These variables are computer anxiety, relative advantage, skill variety and ease of use.

Even though this study can not answer questions related to causation, it did provide a platform for narrowing the field of possible variables for future experiments. Several variables have been identified as poor candidates for future causal experiments. These variables are locus of control, task identity, autonomy and feedback.

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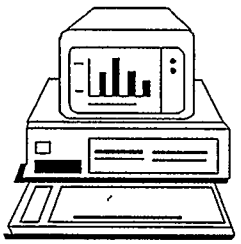
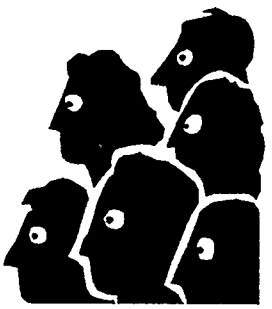
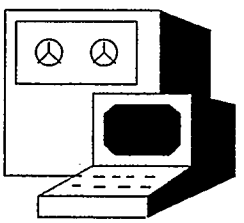
APPENDIX A

END USER ABILITY QUESTIONNAIRE

UNDERSTANDING COMPUTER ABILITY







THE UNIVERSITY OF CALGARY
FACULTY OF MANAGEMENT

WELCOME !!

You are about to participate in a study to identify the characteristics, perceptions and general abilities of computer users. Once identified, these characteristics, perceptions and abilities will be helpful in better serving the needs of users in the future. Your cooperation in answering these questions is strictly voluntary, however, it will be greatly appreciated.

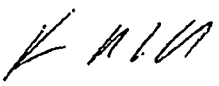
Your answers and opinions are extremely important. The reliability of the findings depend heavily on receiving a response from each person who receives a survey. Each individual's responses will be strictly confidential and used only for this study.

You have been selected because you use a computer in your job. Whether you use it a lot or periodically your answers are important to us.

The survey should take about 20 minutes to complete. The questions are easy to answer and all responses are equally valid. No single response is more correct than any other. There are questions which appear repetitive; please answer them as they too are important to the study. Every effort has been made to only ask questions which are pertinent to this research.

A return addressed envelope is attached for your convenience and for preserving the confidentiality of your responses. Please seal your survey in this envelope and return it to us via internal mail. Your employer will not have access to the completed surveys but will be provided a statistical summary and evaluation of the results. Thank you very much for your participation.

Sincerely,



Kevin Campbell
Faculty of Management
The University of Calgary

PLEASE REMEMBER:

- All information is confidential.
- Answer all questions. Please don't skip any.
- Be honest.
- Answer the questions on your own without any help.
- Move quickly through the questions. We are interested in your first impressions.
- Have Fun!

SECTION I. YOUR PERCEPTION OF COMPUTERS

Please respond to this next group of questions in the **context of your job** with regard to **your use of computers** in general, not just to personal computers. Please **CIRCLE THE NUMBER** that best describes your reaction to each statement.

Use the following scale:

1 = Strongly disagree
2 = Disagree to some extent
3 = Uncertain
4 = Agree to some extent
5 = Strongly agree

EXAMPLE:
If you have no ability as a cook you would **CIRCLE number 1** on the following scale.
Correct Method:
X. I have a lot of ability as a cook.

(1)---------- 2 ---------- 3 ---------- 4 ---------- 5
DISAGREE STRONGLY UNCERTAIN AGREE STRONGLY

DO NOT PLACE CIRCLE OR ANY OTHER MARK BETWEEN NUMBERS ON THE SCALE.
**** CIRCLE THE NUMBER ONLY ****

1. I am confident that I can learn computer skills.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
DISAGREE STRONGLY UNCERTAIN AGREE STRONGLY

2. I am sure of my ability to learn a computer programming language.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
DISAGREE STRONGLY UNCERTAIN AGREE STRONGLY

3. I will be able to keep up with important technological advances in computers.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
DISAGREE STRONGLY UNCERTAIN AGREE STRONGLY

4. I feel apprehensive about using a computer terminal.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
DISAGREE STRONGLY UNCERTAIN AGREE STRONGLY

5. When given the opportunity to use a computer, I am afraid that I might damage it in some way.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
DISAGREE STRONGLY UNCERTAIN AGREE STRONGLY

Change to this scale for the following questions:

1 = Strongly Disagree	**5 = Slightly Agree**
2 = Quite Disagree	**6 = Quite Agree**
3 = Slightly Disagree	**7 = Strongly Agree**
4 = Neither	

6. Using a computer enables me to accomplish tasks more quickly.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

7. My superiors expect me to use a computer.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

8. I believe that a computer is cumbersome to use.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

9. Using a computer improves the quality of work I do.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

10. Using a computer makes it easier to do my job.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

11. It is easy for me to remember how to perform tasks using a computer.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

12. My using a computer requires a lot of mental effort.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

Continue to use this scale for the following questions:

1 = Strongly Disagree
2 = Quite Disagree
3 = Slightly Disagree
4 = Neither
5 = Slightly Agree
6 = Quite Agree
7 = Strongly Agree

13. My use of a computer is voluntary (as opposed to required by my superiors or job description).

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

14. Using a computer is often frustrating.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

15. The disadvantages of my using a computer far outweigh the advantages.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

16. My interaction with a computer is clear and understandable.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

17. I believe that it is easy to get a computer to do what I want it to do.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

18. My boss does not require me to use a computer.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

19. Overall, I believe that a computer is easy to use.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY **NEITHER** **AGREE STRONGLY**

Continue to use this scale for the following questions:

1 = Strongly Disagree	**5 = Slightly Agree**
2 = Quite Disagree	**6 = Quite Agree**
3 = Slightly Disagree	**7 = Strongly Agree**
4 = Neither	

20. Using a computer improves my job performance.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

21. Overall, I find using a computer to be advantageous in my job.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

22. Learning to operate a computer is easy for me.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

23. Using a computer enhances my effectiveness on the job.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

24. Although it might be helpful, using a computer is certainly not compulsory in my job.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

25. Using a computer gives me greater control over my work.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

26. Using a computer increases my productivity.

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7
DISAGREE STRONGLY NEITHER AGREE STRONGLY

Change to this scale for the following questions:

1 = Strongly disagree
2 = Disagree to some extent
3 = Uncertain
4 = Agree to some extent
5 = Strongly agree

27. I avoid computers because they are unfamiliar to me.

1 ---------- 2 ---------- 3 ---------- 4 ----------5
DISAGREE STRONGLY **UNCERTAIN** **AGREE STRONGLY**

28. I hesitate to use a computer for fear of making mistakes that I cannot correct.

1 ---------- 2 ---------- 3 ---------- 4 ----------5
DISAGREE STRONGLY **UNCERTAIN** **AGREE STRONGLY**

29. I am sure of my ability to interpret a computer printout.

1 ---------- 2 ---------- 3 ---------- 4 ----------5
DISAGREE STRONGLY **UNCERTAIN** **AGREE STRONGLY**

30. I have difficulty understanding most technical matters.

1 ---------- 2 ---------- 3 ---------- 4 ----------5
DISAGREE STRONGLY **UNCERTAIN** **AGREE STRONGLY**

31. Computer terminology sounds like confusing jargon to me.

1 ---------- 2 ---------- 3 ---------- 4 ----------5
DISAGREE STRONGLY **UNCERTAIN** **AGREE STRONGLY**

32. On the average, how <u>frequently</u> do you <u>personally</u> use a computer?

FREQUENT 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7 **INFREQUENT**
EXTREMELY QUITE SLIGHTLY NEITHER SLIGHTLY QUITE EXTREMELY

33. Assuming that any decision to use the computer is totally up to you, how would you rate your potential use of the computer in the next six months?

IMPROBABLE 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7 **PROBABLE**
EXTREMELY QUITE SLIGHTLY NEITHER SLIGHTLY QUITE EXTREMELY

SECTION II. COMPUTER ABILITY

The intent of this series of questions is to establish the depth of knowledge and ability that you have with respect to various computer related functions. Think about **your personal use** of a computer **in your** job and respond according to **your best** level of ability in each category.

ABILITY SCALE

The definitions which follow **refer to the ability scale** and represent levels of increasing knowledge and/or ability.

NONE (1 = NONE) — I have no knowledge or ability with this subject.

UNDERSTAND BASICS (2 = BASICS) — I have an introductory level knowledge about the subject. I understand and am familiar with the basic terms and concepts associated with this topic, and am able to perform simple tasks correctly.

FUNCTIONAL WORKING KNOWLEDGE (3 = FWK) — I can apply the principal concepts related to the subject in order to analyze and develop solutions for specific problem situations. I can do many straightforward tasks related to the topic, however, for very complex tasks, I need to get help.

EXPERT (4 = EXPERT) — I have a thorough, in-depth knowledge of the subject matter. I can identify and develop the best solution in complex situations. I can also clearly and adequately communicate my decisions and reasonings. I can help you with any problem you may have.

The major distinction between "Functional Working Knowledge" and "Expert" is one of comprehensiveness and accuracy of knowledge plus extensiveness of experience.

IMPORTANCE SCALE

The definitions which follow **refer to the importance scale** and represent the level of **importance of each ability** when using computers in your job.

VL = Very Low
L = Low
A = Average
H = High
VH = Very High

EXAMPLE:

If you are a truck driver and you are extremely proficient at driving under all conditions (i.e. weather and traffic), you would **CIRCLE VH** UNDER IMPORTANCE and **4** UNDER LEVEL OF ABILITY.

ABILITY TO:	IMPORTANCE TO YOUR JOB PERFORMANCE	CURRENT LEVEL OF ABILITY
X. Drive	VL L A H (VH)	1 2 3 (4)

Please rate BOTH the IMPORTANCE of each ability to your CURRENT use of computers IN YOUR JOB and YOUR BEST CURRENT LEVEL OF ABILITY in each area by CIRCLING the appropriate response in each category.

USE THE FOLLOWING SCALES:

FOR IMPORTANCE:

VL = Very Low
L = Low
A = Average
H = High
VH = Very High

FOR ABILITY LEVEL:

1 = NONE
2 = BASICS
3 = FWK
4 = EXPERT

Answer in relation to your **current** job

ABILITY TO:	IMPORTANCE TO YOUR JOB PERFORMANCE	CURRENT LEVEL OF ABILITY
1. Program (i.e., BASIC, COBOL, PASCAL, etc.)	VL L A H VH	1 2 3 4
2. Use Application Development Software (i.e., LOTUS 123, dBASE III, etc.)	VL L A H VH	1 2 3 4
3. Use Packaged Application Software (i.e., purchased)	VL L A H VH	1 2 3 4
4. Use Office Automation Systems (i.e., electronic mail, calendars, text editing, etc.)	VL L A H VH	1 2 3 4
5. Build Models (i.e., statistical, financial, etc.)	VL L A H VH	1 2 3 4
6. Access Data	VL L A H VH	1 2 3 4
7. Establish Data Communications (i.e., set baud, parity, etc. on Kermit, Procomm and other packages)	VL L A H VH	1 2 3 4
8. Use Hardware	VL L A H VH	1 2 3 4
9. Utilize Graphics Techniques	VL L A H VH	1 2 3 4
10. Use Operating Systems	VL L A H VH	1 2 3 4
11. Understand and Interpret Display Screens and Reports	VL L A H VH	1 2 3 4

SECTION III. PERCEIVED CHARACTERISTICS OF YOUR JOB

This section will obtain your perceptions of your current job.

CIRCLE THE NUMBER which is the most accurate description of your experience in your job.

Please answer as objectively as possible.

1. How much variety is there in your job?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

2. How much are you left on your own to do your own work?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

3. How often do you see projects or jobs through to completion?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

4. To what extent do you find out how well you are doing on the job as you are working?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

5. How repetitious are your duties?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

6. To what extent are you able to act independently of your supervisor in performing your job function?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

7. To what extent do you receive information from your superior on your job performance?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

8. How similar are the tasks you perform in a typical working day?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

9. To what extent are you able to do your job independently of others?

1 ---------- 2 ---------- 3 ---------- 4 ----------5
VERY LITTLE A MODERATE AMOUNT VERY MUCH

10. The feedback from my supervisor on how well I'm doing

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

11. The opportunity to do a number of different things

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

12. The freedom to do pretty much what I want on my job

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

13. The degree to which the work I'm involved with is handled from beginning to end by myself

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

14. The opportunity to find out how well I am doing on my job

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

15. The amount of variety in my job

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

16. The opportunity for independent thought and action

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

17. The opportunity to complete work I start

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

18. The feeling that I know whether I am performing my job well or poorly

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

19. The control I have over the pace of my work

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

20. The opportunity to do a job from the beginning to end (i.e., the chance to do a whole job)

1 ---------- 2 ---------- 3 ---------- 4 ---------- 5
A MINIMUM AMOUNT **A MODERATE AMOUNT** **VERY MUCH**

SECTION IV. YOUR PERCEPTION OF PERSONAL CIRCUMSTANCES

Eleven pairs of statements are given below. From each pair choose the one you agree with more and **CIRCLE** whether it is 'Much Closer' or 'Slightly Closer' to your personal perception.

EXAMPLE:

If you agree with the first statement but it is only **SLIGHTLY CLOSER** to **your personal perceptions** than the second statement then **CIRCLE '(2)'.**

MUCH CLOSER	SLIGHTLY CLOSER		SLIGHTLY CLOSER	MUCH CLOSER

X. People make their own fortune. — 1 ---------(2)------ 3 --------- 4 (MC SC SC MC) — A person's opportunities are beyond his/her control.

NOTE: CIRCLE ONLY ONE OF THE FOUR NUMBERS SHOWN ON THE SCALE.

MUCH CLOSER	SLIGHTLY CLOSER		SLIGHTLY CLOSER	MUCH CLOSER

1. Many of the unhappy things in people's lives are partly due to bad luck. — 1 --------- 2 ------- 3 ----------4 (MC SC SC MC) — People's misfortunes result from the mistakes they make.

2. In the long run, people get the respect they deserve in this world. — 1 --------- 2 ------- 3 ----------4 (MC SC SC MC) — Unfortunately, an individual's worth often passes unrecognized no matter how hard one tries.

3. Without the right breaks, one cannot be an effective leader. — 1 --------- 2 ------- 3 --------- 4 (MC SC SC MC) — Capable people who fail to become leaders have not taken advantage of their opportunities.

4. Becoming a success is a matter of hard work; luck has little or nothing to do with it. — 1 --------- 2 ------ 3 ----------4 (MC SC SC MC) — Getting a good job depends mainly on being in the right place at the right time.

	MUCH CLOSER	SLIGHTLY CLOSER		MUCH CLOSER	
5.	What happens to me is my own doing.	1 MC	2 SC	3 SC	4 MC	Sometimes I feel that I don't have enough control over the direction my life is taking.
6.	When I make plans, I am almost certain that I can make them work.	1 MC	2 SC	3 SC	4 MC	It is not always wise to plan too far ahead, because many things turn out to be a matter of good or bad fortune anyway.
7.	In my case, getting what I want has little or nothing to do with luck.	1 MC	2 SC	3 SC	4 MC	Many times we might just as well decide what to do by flipping a coin.
8.	Who gets to be boss often depends on who was lucky enough to be in the right place first.	1 MC	2 SC	3 SC	4 MC	Getting people to do the right thing depends upon ability; luck has little or nothing to do with it.
9.	Most people don't realize the extent to which their lives are controlled by accidental happenings.	1 MC	2 SC	3 SC	4 MC	There is really no such thing as "luck".
10.	In the long run, the bad things that happen to us are balanced by the good ones.	1 MC	2 SC	3 SC	4 MC	Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
11.	Many times I feel that I have little influence over the things that happen to me.	1 MC	2 SC	3 SC	4 MC	It is impossible for me to believe that chance or luck plays an important role in my life.

SECTION V. GENERAL INFORMATION

The questions contained in this section will elicit general information which will be useful in analyzing your responses and will help us to draw appropriate conclusions.

1. Your sex **(PLEASE CIRCLE):** **(1) MALE** **(2) FEMALE**

2. Your current age: _____ **YEARS**

3. Your department: _____

4. When did you assume your current position: _____ **MONTH** _____ **YEAR** (Optional)

5. When did you begin working with this organization: _____ **MONTH** _____ **YEAR**

6. Highest level of education you completed **(PLEASE CIRCLE):**

   1 GRADE SCHOOL
   2 SOME HIGH SCHOOL
   3 HIGH SCHOOL GRADUATE
   4 SOME TECHNICAL SCHOOL
   5 TECHNICAL SCHOOL GRADUATE
   6 SOME COMMUNITY COLLEGE
   7 SOME UNIVERSITY
   8 COMMUNITY COLLEGE GRADUATE
   9 UNIVERSITY GRADUATE
   10 POSTGRADUATE

7. **CIRCLE THE NUMBER** which best describes your job with respect to organizational level.

   1 EXECUTIVE/TOP MANAGEMENT
   2 MIDDLE MANAGEMENT
   3 SUPERVISORY
   4 PROFESSIONAL
   5 TECHNICAL
   6 CLERICAL
   7 OTHER (Please specify: _____)

8. In the context of your job, do you **personally** perform your own tasks on the computer? **CIRCLE THE NUMBER.**
(i.e. Choose (2) if you delegate **all** your computer tasks.)

(1) YES (2) NO

9. Assuming that any decision to use the computer is totally up to you, how would you rate your potential use of the computer in the next six months?

LIKELY 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ---------- 7 UNLIKELY
EXTREMELY QUITE SLIGHTLY NEITHER SLIGHTLY QUITE EXTREMELY

10. On the average, how <u>often</u> do you <u>personally</u> use a computer?

1 DON'T USE AT ALL
2 USE LESS THAN ONCE EACH WEEK
3 USE ABOUT ONCE EACH WEEK
4 USE SEVERAL TIMES A WEEK
5 USE ABOUT ONCE EACH DAY
6 USE SEVERAL TIMES EACH DAY

YOU'RE FINISHED!

THANK YOU <u>VERY</u> MUCH FOR YOUR PARTICIPATION!

If you wish to add any comments or observations, please use the space on the back or simply attach them to this page.

Please seal the questionnaire in the return addressed envelope and place it in your internal mail.
