1992

Individual Reactions To Computing Technology: A Social Cognitive Theory Perspective

Deborah R. Compeau

Recommended Citation

Compeau, Deborah R., "Individual Reactions To Computing Technology: A Social Cognitive Theory Perspective" (1992). *Digitized Theses*. 2125.
https://ir.lib.uwo.ca/digitizedtheses/2125

INDIVIDUAL REACTIONS TO COMPUTING TECHNOLOGY:

A SOCIAL COGNITIVE THEORY PERSPECTIVE

by

Deborah R. Compeau

School of Business Administration

Submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Graduate Studies
The University of Western Ontario
London, Ontario
August 1992

ISBN 0-315-75324-2

ABSTRACT

Understanding how and why individuals use computers within their professional lives has been a longstanding goal of Information Systems research. In order to provide further insights into this phenomenon, from the perspective of Social Cognitive Theory (Bandura, 1986), two related studies were undertaken. In the first study, a model of individual behaviour based on Social Cognitive Theory was formulated and tested through a survey of approximately 1000 Canadian managers and professionals. The results of the study provide substantial support for the Social Cognitive Theory perspective. In particular, the findings highlight the important role of self-efficacy, individuals' beliefs that they can successfully use computers, in shaping both emotional and behavioural reactions.

The second study focused on the development of skills in two software packages, again using Social Cognitive Theory as a theoretical foundation. An experiment was conducted in which 88 managers and professionals were taught to use Lotus 1-2-3 and WordPerfect through one of two training methods. The first method reflected the traditional lecture and practice approach to training. The second method incorporated behaviour modeling in addition to traditional methods. Modeling was found to influence self-efficacy and performance for training in Lotus, but not in WordPerfect. Self-efficacy was found to influence performance for both packages. Thus, the results suggested that training influences performance in part through its influence on self-efficacy perceptions, and that under some circumstances, training which includes behaviour modeling is more powerful than traditional methods of training.

The combined findings of the two studies underscore the need to consider self-efficacy perceptions in attempting to understand individual reactions to computing technology. On a more general level, they suggest that Social Cognitive Theory is a useful foundation for studies of individual reactions to computing technology. Several specific opportunities for applying Social Cognitive Theory within this domain are suggested in the concluding chapter.

This thesis is dedicated to my father,

who inspired me to pursue an academic career

ACKNOWLEDGEMENTS

In reading and rereading this dissertation, and reflecting on the work that went into it, I am constantly reminded that while my name alone is on the title page, I owe a tremendous debt of gratitude to many people for their support and input.

First, my advisor, Dr. Chris Higgins, provided a working environment in which I could test out new ideas and develop my own ways of thinking. He was a constant source of encouragement (as well as resources) throughout my studies at Western, and an admirable model.

Sid Huff and Colette Frayne provided helpful insights and ideas into the design and implementation of the research, and important feedback on drafts of the dissertation itself. John Hulland, Joan Finegan and Bob Bostrom also provided ideas for strengthening the final product. Susan Braiden, who conducted the training for the experiment, deserves a great deal of credit for her contribution to this work. Her tireless dedication to the project and her skill as a trainer undoubtedly made this a much stronger piece of research. Paul Siess, who produced the videotapes, was also instrumental to the success of the project.

I would also like to thank my colleagues and friends at Western, especially Barb Marcolin, for having the patience to act as "sounding boards" for my ideas (both good and bad) over the course of the research.

Finally, I would like to thank my family for their support throughout my education, but especially through the Ph.D. program. My parents, Tom and Anne Siess, taught me to believe in myself, and to value learning and academic achievement. Most especially, I thank my husband and my best friend, Joe Compeau, for his encouragement, his support, his unselfish sacrifices on my behalf, and his love. Without these, I might never have completed this work.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE - INTRODUCTION

I. The Management Problem

Information technology is a powerful enabling force in organizations. The most prominent examples of this power are the widely publicized success stories describing the ways in which information technologies have led to significant strategic advantage in organizations such as American Hospital Supply (Wiseman, 1985), Foremost McKesson (Clemons & Row, 1988), American Airlines (Copeland & McKenney, 1988), and Merrill Lynch (Wiseman, 1985). Beyond these almost legendary examples, there is ample evidence of the possibilities for using information technology to enhance competitiveness (e.g., Reich & Benbasat, 1990; Runge, 1988).

However, information technology supplies only the means for achieving these benefits. Success through information technology, regardless of the domain, depends on the how the technology is used within the adopting organizations. Max Hopper, the director of American Airlines' SABRE program, believes that in the future:

> astute managers...will focus less on being the first to build proprietary electronic tools than on being the best at using and improving generally available tools to enhance what their organizations already do well (Hopper, 1990, p. 118).

A survey of information systems executives and general managers (Brancheau & Wetherbe, 1987) further supports this notion. The issue which was ranked third by both groups of managers (after Strategic Planning and Competitive Advantage) was Organizational Learning:

> Organizations that prosper in the future will be those that integrate appropriate new IS technologies into their entire operation. ... Education and development will be needed on a massive scale (Brancheau & Wetherbe, 1987, p. 27).

Thus, to benefit from information technology, the focus should be less on *what* technologies are used, than on *how* technologies are used. Being the first to exploit information technology will play a lesser role than being able to make the most out of technologies over the long term.

Making the most out of technologies involves many things. Understanding the role of information within the organization, and focusing on *information* rather than *systems*, is clearly important (Hopper, 1990, p. 121). There is, however, an even more fundamental issue. If the key to success with information technology is how technologies are used, then the power of information technology in organizations is limited by the ability and willingness of individuals to use it in appropriate and effective ways. Systems which are not used, or are used ineffectively, cannot provide positive benefits to an organization.

Delone and McLean (1992) agree. They defined usage as one of the key dimensions of information systems success. In their model, developed after a review of 180 studies of IS success, usage mediates the relationship between the quality of the system (both technical quality and information quality) and the achievement of individual and organizational benefits. Thus, regardless of the value of the information provided, and the quality of the system from a technical perspective, if it is not used by individuals within the firm, no benefits accrue.

Given the centrality of individual behaviour to the attainment of IT success, understanding individual reactions to computing technology[1] is an important issue for IT practitioners, general managers and academics. The management problem to be investigated, then, is as follows:

How can we add to our understanding of individual reactions to computing technology so as to assist people in becoming more productive users of available technologies?

In order to assist people in becoming more productive in their use of information technology, it is first necessary to consider the factors which influence usage and the other outcomes associated with usage. Without an adequate understanding of why people choose to use or to avoid computers, and what factors influence the level of computing skills different people attain, it is impossible to develop ways to assist and support them.

II. The Current State of Research

A substantial body of research has emerged which examines individuals' use of computers. Much of this work, particularly the early studies, was not theoretically grounded, and thus lacked a consistent unifying base (Davis, Bagozzi & Warshaw, 1989; DeSanctis, 1983; Thompson, Higgins & Howell, 1991). More recently, a

---

[1] The phrase *individual reactions to computing technology* is used to refer to the entire collection of dependent variables investigated in this research. It includes both emotional responses, such as anxiety and affect, as well as behavioural responses, such as use of technology and development of computing skills.

number of researchers have attempted to understand computing behaviour from a variety of theoretical perspectives, including Expectancy Theory (DeSanctis, 1983), Fishbein's Theory of Reasoned Action (Davis et al., 1989; Pavri, 1988), Triandis' theory of behaviour and behaviour change (Thompson et al., 1991), and Rogers' Diffusion of Innovation perspective (Brancheau & Wetherbe, 1990; Moore, 1989).

The existing research literature with respect to developing computer skills is more sparse. Only a handful of studies have attempted to examine how computing skills are developed, and the role of computer training in this process. Webster, Heian and Michelman (1990) used Social Information Processing Theory and theories of play to understand how training contributes to performance. Bostrom and his colleagues (Bostrom, Olfman & Sein, 1990; Davis & Bostrom, 1990; Olfman & Bostrom, 1990; Sein & Bostrom, 1989) have developed and tested a model of computer training which incorporates the influence of different mental models of computers and the impact of individual differences on training performance.

One theoretical perspective that has received little attention in IS research is Social Cognitive Theory (Bandura, 1986). While Social Cognitive Theory has been discussed by IS researchers (e.g., Davis et al., 1989), it has not been formally tested within an IS context. Thus, its potential to provide new insights into individual reactions to computing technology has not been thoroughly examined.

III. Theoretical Foundations and Research Questions

Social Cognitive Theory (Bandura, 1977, 1978, 1982, 1986) is a widely accepted, empirically validated model of individual behaviour. It is based on the premise that environmental influences such as social pressures or unique situational characteristics; cognitive and other personal factors, including personality as well as demographic characteristics; and behaviour are reciprocally determined. Thus, individuals choose the environments in which they exist, in addition to being influenced by those environments. Furthermore, behaviour in a given situation is affected by environmental or situational characteristics, which are in turn affected by behaviour. Finally, behaviour is influenced by cognitive and personal factors, and in turn, affects those same factors. This relationship, which Bandura refers to as "triadic reciprocality" is shown in Figure 1.

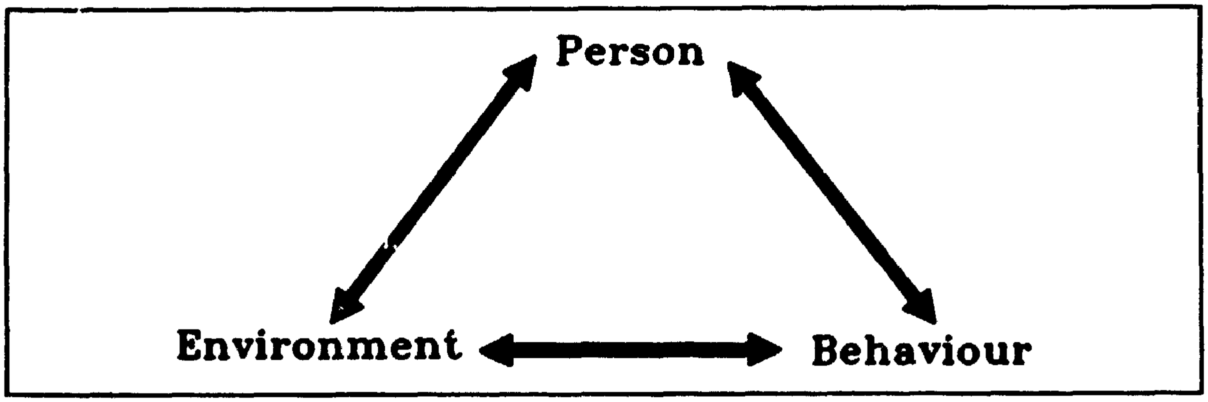


Figure 1. Triadic Reciprocality or Reciprocal Determinism

While Social Cognitive Theory has many dimensions, two parts are particularly relevant to understanding individual reactions to computing technology. The first facet relates to the role of cognitive factors in individual behaviour. Bandura advances two sets of expectations as the major cognitive forces guiding behaviour. The first set of expectations relates to outcomes. Individuals are more likely to undertake behaviours they believe will result in valued outcomes than those which they do not see as having favourable consequences. The second set of expectations encompasses what Bandura calls *self-efficacy*, or beliefs about one's ability to perform a particular behaviour. Self-efficacy influences choices about which behaviours to undertake, the effort and persistence exerted in the face of obstacles to the performance of those behaviours, and thus, ultimately, the mastery of the behaviours.

Outcome expectations have been considered by many IS researchers. The usefulness construct measured by Davis (1989) and Davis et al. (1989) reflects beliefs (or expectations) about outcomes, as does the salient beliefs construct used by Davis et al. (1989). Thompson et al. (1991) tested a model of personal computer use based on Triandis (1980), which included perceived consequences as a central determinant of behaviour. Questions measuring attitudes, such as those used by Robey (1979) also frequently reflect outcome expectations.

While outcome expectations have been considered by many IS researchers, the role of self-efficacy has received less attention. Only a handful of studies consider the role of self-efficacy in computing behaviour (Burkhardt & Brass, 1990; Gist, Schwoerer & Rosen, 1989; Hill, Smith & Mann, 1987; Webster & Martocchio, 1990a, 1990b). These studies provide initial evidence that self-efficacy is an important influence on individual reactions to computing technology.

This research built on existing studies of self-efficacy and outcome expectations and their relationship to behaviour in an attempt to answer the following question:

1. **Do an individual's computer self-efficacy and outcome expectations influence his or her behavioural and emotional reactions to computing technology, and in what ways?**

The second area of Social Cognitive Theory which has particular relevance to this research concerns the acquisition of new behaviours and skills. Much of this research focuses on the use of behaviour modeling, a process in which individuals learn, in part, through the observation of others, as an aid to learning. According to Social Cognitive Theory, behaviour modeling leads to positive changes in the self-efficacy perceptions of the individuals being trained (Bandura, 1982), and in the outcomes they expect if they perform the behaviour (Bandura, 1971). Moreover, modeling demonstrates appropriate and effective strategies for behaviour which can be adopted by the observers (Bandura, 1978, 1982; Schunk, 1981). In the computer training domain, the result of these three influences is a change in the desire to use computers, in the effort exerted in trying to learn to use computers, and in the ability to use computers. The second research question concerns the application of behaviour modeling training to the computing context:

2. **Can a behaviour modeling approach to training be used to enhance computer self-efficacy, outcome expectations, and computer training performance?**

IV. Research Approach

A two-phased study was designed to test the relevant dimensions of Social Cognitive Theory. A measure of computer self-efficacy was developed for this research, based on reviews of the Social Cognitive Theory literature and the relevant literature in Information Systems. In the first phase of the research, a theoretical model of behaviour choice (e.g., whether and to what degree computers are used) was tested in a survey of over 1,000 subscribers to a Canadian business periodical. The model incorporated relevant environmental, cognitive and emotional factors as antecedents to behaviour. A longitudinal assessment of the model was also conducted using a follow up survey of the respondents one year after the initial mailing.

The second phase of the research focused more narrowly on the relationships between self-efficacy, outcome expectations and computer skills, and the changes in these constructs in response to a training intervention. Eighty-eight subjects were taught to use both a spreadsheet package and a word processing package. All subjects received an introductory lecture to teach the basic concepts of the software. Half of the subjects also received a behaviour modeling treatment in the form of a videotaped model using the software. Structural equations modeling was used to examine the influence of the training method, as well as the software package, on self-efficacy and outcome expectations, and the influence of all of these factors on a test of software performance.

V. Contributions

This research makes three primary contributions, which have implications both from a managerial and an academic perspective.

The first contribution is the introduction of the concept of computer self-efficacy, and the demonstration of its importance. Historically, getting people to use computers (when use is optional) has been viewed as a matter of convincing them of the benefits of using computers. Social Cognitive Theory, however, suggests that even when people believe a certain behaviour would be beneficial (i.e., when they have positive outcome expectations), they may still avoid the behaviour if they do not see themselves as capable of carrying it out. Thus, individuals may continue to avoid computers in their work, in spite of the presence of positive outcomes, because they lack a sense of computer self-efficacy.

The research also provides insights into how self-efficacy judgments are formed and changed through actual experience with the behaviour, or through the observation of others' behaviour (i.e., behaviour modeling). Both the survey and the experiment test the influences of various environmental factors on self-efficacy. The findings with respect to this aspect of the research have implications for the design of formal training programs in organizations, as well as for the provision of end user support.

Finally, the research considers multiple dimensions of individual reactions to computing technology. The survey incorporates both emotional responses to computers, such as positive affect and anxiety, and usage. The experiment considers the process of skill development. As a result, the combined studies help to explain, not only why people choose to use computers, but also why different people develop differing levels of skill with respect to using computers.

If the hypotheses are supported then, from a managerial perspective, this research suggests that individual reactions to computing technology can best be influenced through the promotion of high self-efficacy and high outcome expectations. It is not sufficient to tout the benefits of computer use as a rationale for using computers, since individuals who lack self-efficacy will not respond to this type of promotion. Furthermore, the research provides insights into how self-efficacy and outcome expectations may be influenced through actual experience with computers and through behaviour modeling training.

From an academic perspective, this research contributes to the formation of a cumulative body of knowledge regarding individual reactions to computing technology. The introduction of Social Cognitive Theory as a basis for studying this phenomenon provides an integrating, rather than competing perspective. In conducting this research, care was taken to integrate the existing knowledge with respect to individual reactions to computing technology within the framework of Social Cognitive Theory. The survey, in particular, incorporates many concepts which have been previously studied by IS researchers. Thus, the research introduces an important new theory and an important new concept, self-efficacy, but also incorporates and extends existing knowledge from previous research.

VI. Dissertation Organization

Chapter Two discusses the theoretical and empirical foundations for this research. Both the perspectives of information systems research and of Social Cognitive Theory are discussed. Particular attention is paid to exposition of the self-efficacy and behaviour modeling concepts. Chapter Three describes the first phase of the research. The development of the computer self-efficacy measure is described and the research model and data analysis from the surveys are presented. Chapter Four describes the training experiment, and the results of the data analysis. The major findings of each study (the survey and the experiment) are highlighted in the relevant chapters. Chapter Five discusses the contributions and limitations of this research and its implications for IS research and practice.

CHAPTER TWO - THEORETICAL AND EMPIRICAL FOUNDATIONS

I. Overview

The purpose of this research was to test a Social Cognitive Theory (Bandura, 1977, 1878, 1982, 1986) model of individual reactions to computing technology. Social Cognitive Theory was adopted as a theoretical foundation because it offered several advantages relative to the perspectives that had been adopted in previous information systems research. The research also attempted, on a broader level, to provide a more complete and accurate understanding of the individual reactions to computing technology phenomenon than was reflected in the existing research literature.

This chapter reviews the IS research that has examined individual reactions to computing technology. Both the variables studied and the theoretical perspectives adopted are considered. In terms of variables studied, this review uncovers a number of inconsistencies in results, suggesting an inadequate understanding of the phenomenon. The measurement of variables such as training and organizational support are particularly strong manifestations of this lack of understanding. From a theoretical perspective, the review also points out limitations in current research. A comparison of the theoretical perspectives adopted by IS researchers to the perspective of Social Cognitive Theory indicates several ways in which the application of Social Cognitive Theory may improve this understanding. The chapter concludes by outlining two specific aspects of Social Cognitive Theory with the greatest promise to further understanding of individual reactions to computing technology: the concept of self-efficacy, and the Social Cognitive Theory perspective on skill acquisition, specifically through behaviour modeling.

II. Perspectives from Information Systems Research

A substantial body of literature, directed towards understanding why individuals react in particular ways to the introduction of computing technology, has accumulated in the last two decades. This section reviews this literature in terms of key variables studied and theoretical perspectives taken. Thirty-four studies dating from 1974 to 1991 were included in this review (Figure 2 shows a list of studies included in the review).

Alavi & Henderson (1981)
Barki & Huff (1990)
Baronas & Louis (1988)
Baroudi, Olson & Ives (1986)
Brancheau & Wetherbe (1990)
Davis (1989)
Davis, Bagozzi & Warshaw (1989)
DeSanctis (1983)
Franz & Robey (1986)
Fuerst & Cheney (1982)
Gallo (1986)
Ginzberg (1981a)
Ginzberg (1981b)
Igbaria (1990)
Igbaria, Pavri & Huff (1989)
Leonard-Barton & Deschamps (1988)
Lucas (1974)
Lucas (1975a)
Lucas (1975b)
Lucas (1978)
Maish (1979)
Montazemi (1988)
Nelson & Cheney (1987b)
Olson & Ives (1982)
Pavri (1988)
Raymond (1985)
Raymond (1988)
Raymond, Bergeron & Bedard (1990)
Robey (1979)
Sanders & Courtney (1985)
Schewe (1976)
Tait & Vessey (1988)
Thompson, Higgins & Howell (1991)
Zmud (1980)

Figure 2. Studies Included in the Review of Literature

The studies chosen examined the impact of various independent variables on at least one of two dependent variables. System use was examined in 26 of the studies.

System use was typically measured as the overall frequency and/or duration of use (e.g., Davis et al., 1989; Pavri, 1988; Thompson et al., 1991), but was also measured in terms of the degree of use of particular applications (e.g., Igbaria, Pavri & Huff, 1989) and degree of use in a particular task or decision context (e.g., Barki & Huff, 1990; Igbaria et al., 1989; Pavri, 1988). Satisfaction with the system(s) was the second dependent variable used in IS research (13 studies). The predominant measure of satisfaction was the User Information Satisfaction measure developed by Ives, Olson & Baroudi (1983) or the Bailey and Pearson (1983) measure that preceded it (e.g., Alavi & Henderson, 1981; Barki & Huff, 1990; Montazemi, 1988). These two variables reflect the primary dependent variables in IS research on individual reactions to computing technology.

It should be noted that a number of studies examining influences on User Information Satisfaction (UIS) were not included in this review. These studies were excluded because UIS was not measured as an indication of individual reactions to computing technology, but rather as an indication of the organizational success of the technology. Thus, the individuals responding to these questions were acting as key informants for an organizational construct rather than reporting on their own thoughts and behaviours.

Independent Variables Studied

The independent variables which have been used to predict use and satisfaction can be grouped into three main categories: characteristics of the information system(s), characteristics of the organizational context, and characteristics of the individual. A number of studies examined each of these components. The reviews are generally supportive of the influence of each category on use and satisfaction, but many inconsistencies in results are apparent.

Information Systems Characteristics

Early studies on the impact of information systems characteristics focused primarily on the quality of the information system (Fuerst & Cheney, 1982; Lucas, 1974, 1975a, 1975b, 1978; Maish, 1979; Schewe, 1976). Maish (1979) found that flexibility, accessibility, and perceived quality were significantly related to the use of an information system. Similarly, Lucas (1974, 1975a, 1975b, 1978) found that the quality of output, as rated by either users or systems professionals, was a significant predictor of use.

While these characteristics are still being studied (e.g., Barki & Huff, 1990, Igbaria et al., 1989), the trend in more recent studies has been to capture information systems characteristics in terms of usefulness and ease of use (e.g., Davis, 1989; Davis et al., 1989; Tait & Vessey, 1988; Thompson et al., 1991). Usefulness and ease of use have the advantage of making it easier to compare across disparate systems and organizations, since they provide a common basis for comparison. However, the switch to using usefulness and ease of use to reflect information systems characteristics, while it does appear to have improved consistency in results, creates other problems. Usefulness and ease of use represent the users' perceptions of the system and thus mix both information systems characteristics and individual characteristics in the same construct. From a theoretical perspective, mixing these constructs makes interpretation of the results somewhat difficult. Thus, more work is needed in this area to understand the relative contribution of individual and information systems characteristics to the usefulness and ease of use measures.

Organizational Context Characteristics

Three constructs have dominated the research on organizational context of information systems use: training, user involvement, and organizational support. However, the findings regarding each of these constructs have been somewhat mixed. With respect to training, Igbaria et al. (1989), Barki & Huff (1990), and Raymond (1988) found a positive relationship between training and system use. Leonard-Barton and Deschamps (1988) and Nelson and Cheney (1987b), on the other hand, found no significant relationship between training and use. Similar inconsistencies are found for the influence of training on satisfaction. Barki and Huff (1990) found that the degree of training received was significantly related to satisfaction with a decision support system. Sanders and Courtney (1985) also found a positive relationship between training and satisfaction with a decision support system. Raymond (1988) and Raymond, Bergeron and Bedard (1990), however, found no relationship between training and the satisfaction of managers of small businesses with their information systems.

User involvement has been found to be related to use and satisfaction by several authors (e.g., Alavi & Henderson, 1981; Barki & Huff, 1990; Baroudi, Olson & Ives, 1986). Not all of the empirical evidence is positive, however. Fuerst and Cheney (1982) found no evidence of a relationship between user involvement and use of a decision support system, and Tait and Vessey (1988) found no relationship between involvement in system development and user information satisfaction.

The findings regarding organizational support (Barki & Huff, 1990; Fuerst & Cheney, 1982; Leonard-Barton & Deschamps, 1988; Lucas, 1975a, 1975b, 1978; Maish, 1979; Robey, 1979; Sanders & Courtney, 1985) are similarly inconsistent. While several authors have found evidence of a positive relationship between perceived organizational support and use of information technology (Barki & Huff, 1990; Lucas, 1975a, 1975b, 1978; Maish, 1979; Robey, 1979; Thompson et al., 1991) Fuerst and Cheney (1982) found no relationship between support and use. Leonard-Barton and Deschamps (1988) found that the relationship between organizational support and use was moderated by the perceived importance of information technology and by certain individual characteristics. Specifically, for individuals who view computers as unimportant to their jobs, management support did influence use. Similarly, for low performers and for individuals who scored low on innovativeness, support influenced use.

Originally conceived as the supportiveness of top management towards a particular innovation (e.g., Lucas, 1975a, 1975b), the concept of organizational support has broadened considerably in recent studies. The overall stance of the organization (rather than just "top management") was found by Ginzberg (1981) to be a significant factor in distinguishing between success and failure in information systems implementation. Thompson et al. (1991) used a concept called Social Factors in a study of the adoption of personal computers by knowledge workers. This concept incorporated both the support of top management, as well as the encouragement of peers and others. Pavri (1988) and Davis et al. (1989), drawing on the work of Fishbein and Ajzen (1975), introduced the concept of Social Norm as a predictor of use. Another dimension of support has also emerged in some recent studies, albeit with mixed support. Thompson et al. (1991) and Igbaria (1990) tested the impact of support in terms of technical assistance (e.g., presence of an information centre) on use. While Igbaria (1990) found that technical support was related to both use and satisfaction, Thompson et al. (1991) found no significant relationship between support (their Facilitating Conditions construct) and the use of personal computers.

Overall, the research on organizational context factors has confirmed that these factors influence behaviour. However, the number of studies reporting contradictory results suggests that this aspect of individual reaction to computing technology is, even now, poorly understood. The training research discussed above is a good example. Of the seven studies reviewed, three used a binary variable to represent training (Leonard-Barton & Deschamps, 1988; Raymond, 1988; Raymond et al., 1990), two used an overall perception of actual training received (Barki & Huff, 1990; Sanders & Courtney, 1985) and two used a measure of the quantity of training received from different sources, such as software vendors and colleges (Igbaria et al., 1989; Nelson & Cheney, 1987b).

The first approach (binary variable) assumes that all training, regardless of source, quantity, quality, method or content has equal power to influence use. The second approach (overall measure of quantity), while a substantial improvement over the first, assumes that only the degree of training matters. The third approach, yet again an improvement, takes into account both quantity and source of training. However, the content and quality of the training received is not considered in any of these measures. Given the findings from the training literature regarding the impact of different styles of training on learning and the interaction of training styles with individual characteristics (e.g., Bostrom et al., 1990), it is clear that the measures of training are inadequate and it is hardly surprising that the findings are conflicting. Note, however, that this is not a limitation in measurement alone, but more broadly in the understanding of the role of training in individuals' interactions with computers that leads to such faulty measures.

Similarly, for organizational support, the measurement of the construct in different studies reflected different underlying perspectives on what is meant by organizational support. These perspectives have strikingly different implications for behaviour. Here again, what is lacking is a rich conceptual understanding of the influence of others' behaviour on individuals' reaction to computing technology.

Characteristics of the Individual

The area of individual characteristics has undergone the most radical change of any of the three categories reviewed. Early studies in this area focused on factors such as cognitive style (Alavi & Henderson, 1981; Fuerst & Cheney, 1982; Lucas, 1974, 1975a, 1975b, 1978; Zmud, 1980), age (Schewe, 1976; Fuerst & Cheney, 1982) and other demographic variables. The results of these studies were generally weak and inconsistent, suggesting that the impact of such factors was more complex than originally conceived.

As a result of the poor findings in this area, attention has shifted towards cognitively-oriented individual variables, such as expected consequences of use/non-use (Barki & Huff, 1990; DeSanctis, 1983; Gallo, 1986; Pavri, 1988; Tait & Vessey, 1988; Thompson et al., 1991) anxiety (Igbaria et al., 1989; Pavri, 1988), and attitude or affect (Davis et al., 1989; Pavri, 1988; Thompson et al., 1991). These variables produce more consistent results, suggesting that individual cognitions rather than demographics are the important influences on behaviour.

The primary differences among these studies of how individual characteristics influence computer use is the theoretical perspectives which guide the research. Several different perspectives have been adopted in recent research, and are discussed in the next section of the literature review.

Summary

Overall, the results from existing IS research indicate that individual reactions to computing technology, specifically use and satisfaction, are influenced by factors from each of the three categories: individual characteristics, organizational characteristics and system characteristics. However, the specific variables which exert the strongest influence, and the nature of the relationships between the variables is far from well understood.

Theoretical Perspectives Adopted

While much of the early work, and even some of the more current research, was largely atheoretical, a number of researchers have turned to theories from reference disciplines as a foundation for their work. DeSanctis (1983) adopted an Expectancy Theory perspective on the use of a decision support system. Pavri (1988) analyzed the use of personal computers from the perspective of the Theory of Reasoned Action (Fishbein & Ajzen, 1975). Davis et al., (1989) used a modified version of the Theory of Reasoned Action to understand the role of usefulness and ease of use in the adoption of information technology. Thompson et al., (1991) utilized Triandis' (1980) theory of interpersonal behaviour as a basis for studying knowledge workers' use of personal computers. Moore (1989) studied the use of information technology from a Diffusion of Innovations perspective, drawing heavily on the work of Rogers (1983) for theoretical justification. These four theoretical perspectives are reviewed below.

Expectancy Theory

Expectancy Theory was developed by Vroom (1964) as a theoretical foundation for the study of work motivation. The theory holds that "the choices made by a person among alternative courses of action are lawfully related to psychological events occurring contemporaneously with the behavior" (Vroom, 1964, pp. 14-15). Specifically, the motivation to undertake a behaviour is seen as a function of the individual's expectations of the consequences or outcomes of the behaviour and his or her valence for those outcomes. Valence is defined as the affective orientation toward the outcomes, or the desirability of the outcomes to the individual. Valence can be positive (the individual desires the outcome), zero (the individual is indifferent to the outcome) or negative (the individual desires not to have the outcome). For example, the motivation to use a computer is calculated as the sum of all of the outcomes resulting from computer use (e.g., increased productivity, decreased autonomy, eye strain) multiplied by the valence (attractiveness) of those outcomes to the individual.

The valence of a particular outcome is considered by Vroom (1964) to be a function of the association between the outcome and other, second level, outcomes (instrumentality) and the valence of those second level outcomes. Thus, the valence of an outcome such as "increased productivity" is determined by the probability that it will lead to other outcomes, such as "higher pay" or "not being fired" and the valences of these outcomes.

These relationships are mathematically represented in the following equations:

$$M_i = f_i[\sum_{j=1}^{n}(E_{ij}V_j)] \quad (1)$$

where M_i is the motivation tc perform act i,
f_i is an unspecified mathematical function,
E_{ij} is the expectation that act i will lead to outcome j, and
V_j is the valence of outcome j.

$$V_j = f_j[\sum_{k=1}^{n}(V_k I_{jk})] \quad (2)$$

where V_j is the valence of outcome j,
f_j is an unspecified mathematical function,
V_k is the valence of outcome k, and
I_{jk} (instrumentality) is the probability that outcome j will lead to outcome k.

DeSanctis (1983) adopted expectancy theory as a basis to study the use of a Decision Support System. Eighty-eight senior undergraduate students were taught to use a DSS as part of a business simulation game. The DSS was described as a system that provided participants with "information and decision models which [were] useful, but not necessary for decision making" (DeSanctis, 1983, p.253) in the simulation. At two points in the simulation, subjects were asked to rate the probabilities that high and low use of the DSS would lead to high and low performance (expectancy), that high and low performance would lead to high and low levels of two different rewards (instrumentality), and the desirability of the two rewards (valence). Their use of the DSS in subsequent decisions was measured as the dependent variable. The results indicate "weak to moderate support" (p. 257) for the relationships between valence, instrumentality, expectancy and behaviour, although the variance explained in use was less than five percent.

Gallo (1986) also tested an expectancy theory model of computing behaviour, based on Porter and Lawler's (1968) revision of Vroom's Expectancy Theory. The revised model suggests that motivation to perform a behaviour is a function of the individual's belief that different levels of effort will lead to different levels of performance (effort-performance expectancies or Expectancy), his or her belief that different levels of performance will lead to different levels of particular outcomes (performance-outcome expectancies or Instrumentality) and the value of those outcomes (Valence). In Gallo's study, eighty-four undergraduate students completed two questionnaires. The first measured their intention to enrol in a non-credit computer course (the dependent variable). The second questionnaire measured (1) the subjects' beliefs that they could learn to use computers by exerting a high degree of effort (Expectancy); (2) their expectations that learning to use computers would result in particular outcomes (Instrumentality); and (3) the desirability of those outcomes (Valence). The results indicated that this revised Expectancy Theory model could predict individual intention to enrol in a computer course. Overall, the model explained 22% of the variance in intention. However, a hierarchical regression analysis indicated that the only factor which significantly influenced intention was instrumentality.

Theory of Reasoned Action

The Theory of Reasoned Action is one of the best known theories of individual choice behaviour used in Information Systems research. A number of studies have tested the theory (Davis et al., 1989; Moore, 1989; Pavri, 1988). Figure 3 displays a conceptual model of the theory.

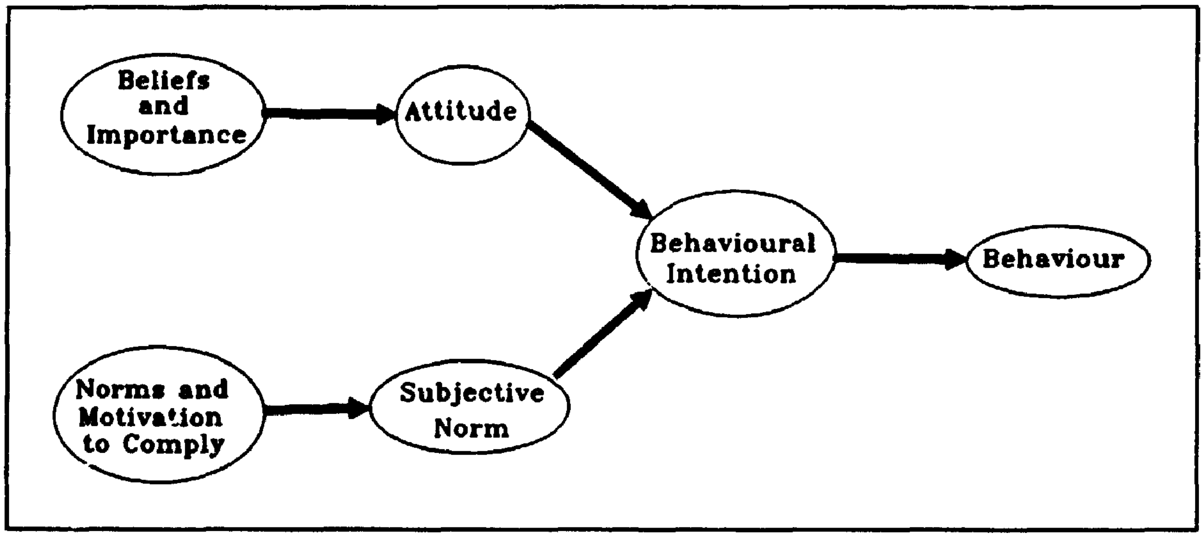


Figure 3. The Theory of Reasoned Action (Fishbein & Ajzen, 1975).

According to the theory, behaviour is a function of individuals' intentions. That is, an individual's belief that he or she is likely to perform a behaviour is the best predictor of his or her actual behaviour. Fishbein and Ajzen (1975) acknowledged that other factors might constrain an individual from performing a behaviour, regardless of intentions; however, the model only includes intentions as a direct precursor to behaviour. Thus, in terms of computer use, an individual's use of computers is determined by his or her intention to do so.

Behavioural intentions are influenced by two factors. An individual's attitude towards performing the behaviour is the first factor. Attitude is conceived as an affective and/or evaluative reaction to the performance of the behaviour. While attitude is considered to encompass more than affective reaction, this component of attitude is given prominence in the theory due to "widespread agreement that affect is the most essential part of the attitude concept" (Fishbein & Ajzen, 1975, p. 11). The second factor influencing behavioural intentions is the individual's subjective norm concerning the behaviour, that is, the individual's belief that important others think he or she should or should not perform the behaviour. Attitude and subjective norm are the only variables which the Theory of Reasoned Action predicts will directly influence behavioural intentions. Any other factors can influence behavioural intention only indirectly, through one or both of attitude and subjective norm. Thus, an individual's affective or evaluative reaction to using computers (attitude) and his or her belief that important others feel he or she should use computers (subjective norm) influence the intention to do so. Any other factors (e.g., training, management support, system characteristics, individual differences) can only influence computer usage intentions (and thus computer use) if they affect one or both of these mediating factors.

Attitudes are formed, according to the theory, on the basis of the individual's beliefs about the probable outcomes of the behaviour and evaluations of those outcomes. Thus, if the use of computers is viewed as resulting in personal or job rewards that are valued by the individual, he or she will develop a favourable attitude towards the use of computers. Conversely, if the use of computers is viewed as resulting in negative consequences, an unfavourable attitude will result.

The subjective norm concerning a behaviour is a function of beliefs that various referent groups feel an individual should or should not perform the behaviour, and the individual's motivation to comply with those referent groups. Thus, if an individual feels, for example, that his or her peers and superiors expect use of computers, and he or she is motivated to do what those peers and superiors expect, this individual will choose to use computers.

Within an IS context, four authors have explicitly tested the Theory of Reasoned Action. Pavri (1988) examined the factors which influence microcomputer usage of 519 Canadian managers and professionals. He found that attitude and social norms were both significant predictors of use. In addition, he found that attitudes were directly influenced by beliefs, anxiety, perceived quality of the system and perceived support, and indirectly influenced (with anxiety as a mediator) by skills (self-rated) and perceived quality. Social norms were found to be primarily influenced by management support and perceived use of computers by peers and by management. Twenty-two percent of the variance in use was explained by the model.

Davis et al. (1989) tested the Theory of Reasoned Action as a predictor of the use of a word processing system for MBA students. Beliefs and their importance, norms and the motivation to comply, attitude and intention were measured following an introductory training session on the software. Actual use (self-reported) was measured at the end of the term. Consistent with the theory, the authors found that behavioural intention significantly predicted use ($R^2=0.12$), and that attitudes significantly predicted behavioural intention ($R^2=0.32$). On the other hand, subjective norm did not significantly predict attitude. Moreover, while beliefs and their importance did significantly predict attitude, only 7% of the variance in attitude was explained. Furthermore, beliefs were found to have a direct impact on behavioural intention, over and above the influence through attitude. Thus, while the study confirms some predictions of the Theory of Reasoned Action, other findings were not supportive of the theory.

Mathieson (1991) compared Davis et al.'s (1989) Technology Acceptance Model to the Theory of Planned Behaviour, which was also based on Fishbein and Ajzen's original model. Two hundred forty seven undergraduate students completed one of two computer-based questionnaires regarding their attitudes towards and intentions to use a spreadsheet package in completing a course assignment. The specific predictor variables differed across the two questionnaires to capture the different constructs in the two theoretical models. The results provided substantial support for both models, explaining approximately 70% of the variance in behavioural intention with the Technology Acceptance Model and 62% with the Theory of Planned Behaviour.

Moore (1989) combined two perspectives in formulating and testing a model of the use of personal workstations. Both the Theory of Reasoned Action and the

Diffusion of Innovations perspective were incorporated into the model. The findings with respect to the Diffusion of Innovations perspective are discussed in a later section. With respect to the Theory of Reasoned Action, he found that both attitudes and subjective norms influenced the adoption of the technology. Users of the personal workstations had more positive attitudes towards computers than did non users and held stronger beliefs that a variety of reference groups, (peers, friends, supervisors, senior managers and subordinates) wanted them to use computers. In addition to adoption, the innovativeness of usage (number of functions used, frequency of use, months since adopted, and hours of use per week) was also studied. Innovativeness was found to be influenced by attitude, but not by subjective norm.

Triandis

Triandis (1980) described a theory of behaviour which synthesized much of the existing literature on behaviour, from sociological, psychological and anthropological roots. Triandis' model incorporates the notion that the expected consequences of a behaviour and their desirability to the individual are a central determinant of motivation. In addition, the concepts of intention and social factors, present in the Theory of Reasoned Action, are included in the model.

Triandis (1980) argued that "attitude is a laymen's term, and it is not necessary for a rigorous discussion of the links between predispositions to action and behavior" (p.214). Thus, his conceptualization of the antecedents differs somewhat from that of Fishbein and Ajzen (1975). Triandis agrees that the immediate antecedent of behaviour is behavioural intention, but contrary to the Theory of Reasoned Action, he contends that affect (similar to Attitude in TRA) and perceived consequences (similar to the TRA beliefs construct) are independent predictors of behavioural intention.

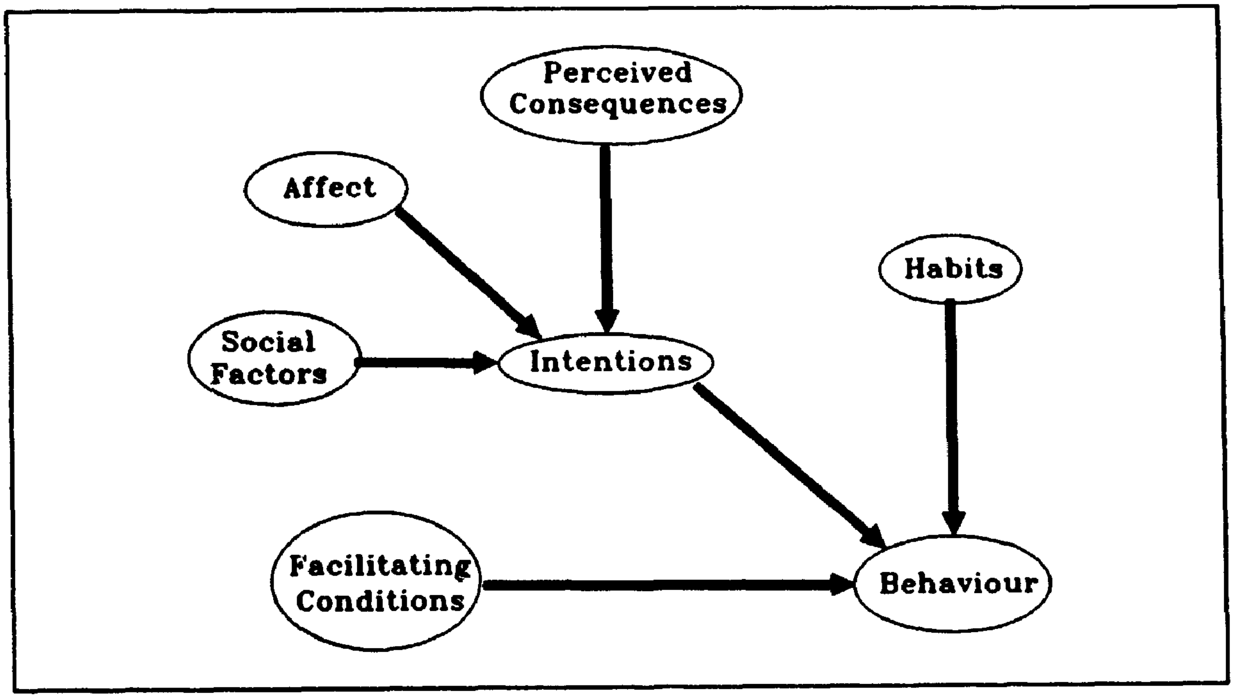


Figure 4. Triandis' Model of Individual Behaviour

In addition to the concepts discussed above, Triandis incorporates habits and facilitating conditions as central concepts in the predisposition to action. He argues that much of human behaviour is carried out without explicit consideration of the consequences, social norms etc. - it is habitual and therefore not questioned. Triandis also argues that even when habits, perceived consequences, social factors and affect result in an intention to behave in a particular way, the characteristics of the situation may preclude the behaviour. For example, an individual may intend to use computers in his or her job, but may be unable to obtain access to a computer. Thus, facilitating conditions are an important component of the Triandis model. The social factors construct in the Triandis model is similar to the Social Norms concept used by Fishbein and Ajzen, but is broader. It incorporates norms as well as perceptions of roles and values. The result is a concept which incorporates "the individual's conceptions of behaviors which are appropriate, desirable, and morally correct" (p. 210). Figure 4 shows the major relationships in Triandis' model.

Thompson et al., (1991) tested Triandis' theory in the context of personal computer adoption. Their model included four of the constructs Triandis posited as antecedents of behaviour: perceived consequences, affect, social factors and facilitating conditions. Behavioural intentions and habits, while acknowledged as important components of the model, were not tested. The authors found a significant relationship between perceived consequences and personal computer use, as well as between social factors and personal computer use. Neither affect nor facilitating conditions was significantly related to use. Overall, the model explained 24% of the variance in use. While some of the lack of findings may be attributed to measurement limitations of the study, the Triandis model is only partially supported by this study.

Diffusion of Innovations

Rogers (1983) proposed the Diffusion of Innovations perspective as a means to understand the adoption of innovations. He suggested that during the innovation decision process:

> an individual passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of the decision. (p. 163)

An individual's progression through these five stages is driven by a desire to resolve dissonance. For example, an individual who has heard that a particular computer application can help with a part of his or her job will be driven to seek more information about the application, since to not do so would be a contradiction of his or her self-image and would, therefore, create a feeling of dissonance. Similarly, once the individual had formed a favourable attitude towards the innovation, he or she would adopt it, since to reject it would result in dissonance.

Diffusion of Innovations theory was developed to understand the rate of adoption of innovations in a social group, rather than the behaviour of individuals within those groups. However, several researchers have demonstrated that the predictions can be applied to individual decision making regarding innovations as well as to the rate of adoption.

Rogers asserts that the perceived attributes of the innovation are an important determinant of the decision to adopt. He outlines five attributes which have a substantial influence on the decision. First, he argues that innovations which are perceived as better than those they supersede (i.e., have *relative advantage*) are more likely to be adopted. Second, he asserts that the degree to which an innovation is consistent with existing values and ways of behaving, or its *compatibility*, will also influence adoption. The *complexity* of the innovation, or the degree to which it is relatively difficult or easy to understand is the third perceived characteristic which Rogers argues will influence adoption. In addition, the *trialability* of the innovation, or the degree to which it can be tried on a limited basis before committing to a decision, and its *observability*, the extent to which the results of adoption are visible to others, are postulated by Rogers to influence the adoption decision.

Rogers also considers aspects of the environment, or organizational context, as determinants of adoption. First, the nature of the adoption decision is purported to influence the rate of adoption within an organization, in that individual optional decisions and decisions made by an authority with sufficient power to carry out the decision, will be made more quickly than decisions made by a collective. At the individual level, adoption may be mandatory or voluntary. The specific use/non-use may be dictated, but the degree of use may differ.

The type of communication channels used to publicize the innovation will also influence its rate of adoption. Mass media channels convey information to a large group of people, but may have less persuasive appeal than interpersonal channels. Rogers suggests that the influence of channels may interact with innovation characteristics and stage of decision process.

The nature of the social system is the third "organizational context" variable discussed by Rogers (1983). The prevailing norms and the degree of interconnectedness (or cohesion) of the social group will influence the rate of adoption. If norms favour adoption it will occur more quickly, especially if the group is highly cohesive. On the other hand, a highly cohesive group with norms counter to adoption, will result in slow adoption (or rejection) of the innovation.

Finally, the extent of the change agent's efforts to promote the innovation will influence its rate of adoption. Rogers argues that innovations which are actively promoted by a change agent are more likely to be adopted and will be adopted more quickly than those which do not enjoy this type of promotion. Figure 5 shows Rogers' perspective on the factors influencing innovation adoption.

Two recent studies have examined the Diffusion of Innovations perspective on information technology adoption. Moore (1989), as discussed earlier (see page 28), studied the adoption of personal workstations in seven organizations. His model included the perceived voluntariness of the innovation, the prevailing norms regarding the innovation, and the perceived characteristics of the innovation. In addition to the five characteristics of innovations discussed above, Moore included "image", reflecting the impact of adoption on the individual's social status (which might be considered as a subdimension of relative advantage) and "visibility", reflecting the physical observability of the innovation (a component of Rogers' observability). Compared to non-users, users of the workstations viewed the innovations much more

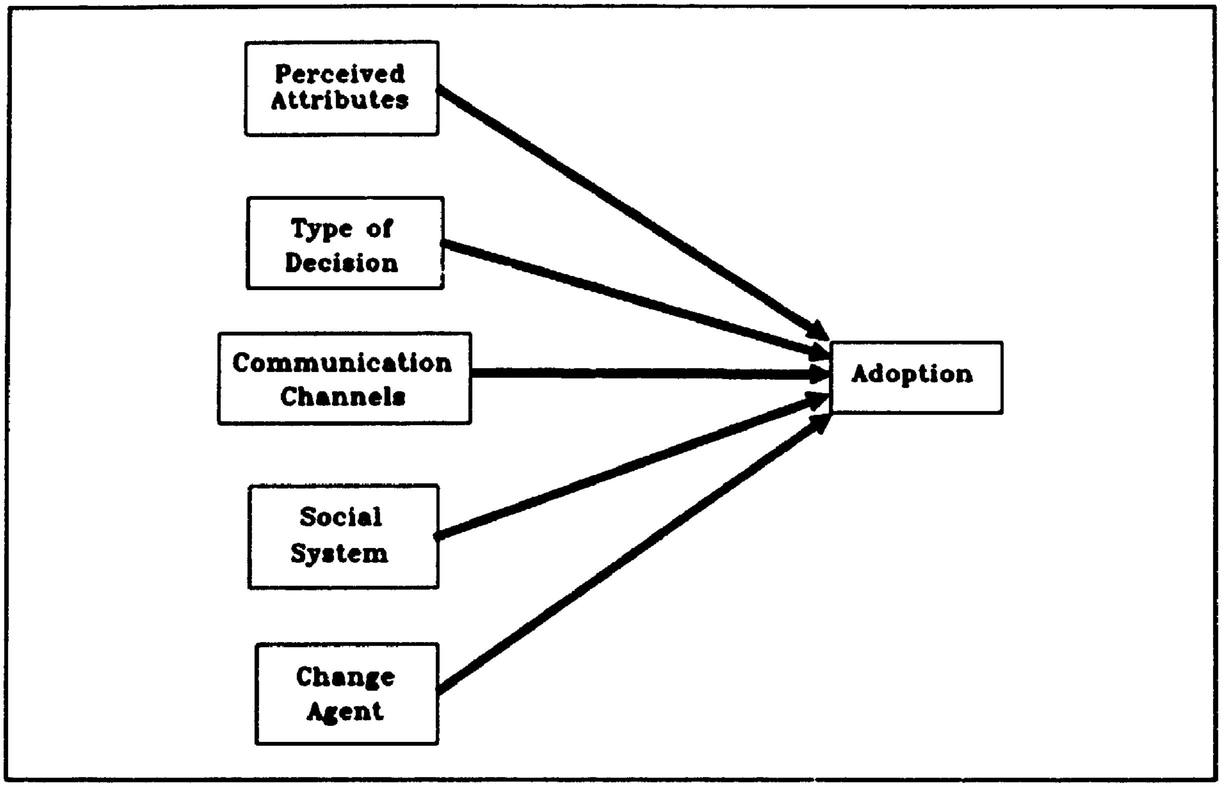


Figure 5. Rogers' (1983) Perspective on Innovation Adoption

positively and perceived stronger norms to use. Moreover, the perceived characteristics of the innovation, voluntariness, and subjective norm were found to predict degree of use in addition to simple use or non-use.

A number of other researchers in IS (e.g., Brancheau & Wetherbe, 1990) have also studied technology adoption from a Diffusion of Innovations perspective. However, these studies focused more at the organizational level of analysis, attempting to understand the rate of adoption, rather than individual adoption choices, and are thus not reviewed here.

Summary

Review of these four theoretical perspectives suggests two common elements. First, the theories all share a cognitive foundation, that is, they presume that people consider their behaviour and its likely consequences before taking action. This commonality is largely attributable to the common roots of the theories. Fishbein and Ajzen (1975), Triandis (1980) and Rogers (1983) all acknowledge the contributions of Vroom's (1964) theorizing about motivation.

Second, most of the theories incorporate perceptions of others and their expectations as determinants of action. Thus, the importance of the environmental context in which behaviour occurs is recognized by all of the theorists.

III. Social Cognitive Theory as an Alternative Perspective

The theoretical perspectives adopted by IS researchers to understand individual reactions to computing technology have provided significant insights into the phenomenon. However, a number of limitations are inherent in all of these perspectives relative to the perspective of Social Cognitive Theory.

The following sections introduce Social Cognitive Theory through comparison to the existing perspectives on three dimensions: (1) the conceptualization of the relationships among individual factors, environmental factors and behaviour, (2) the types of behaviours explained by the theories, and (3) the cognitive variables predicted to influence behaviour.

Relationships among Individual, Environment and Behaviour

Information systems research on individual reactions to computing technology can best be characterized as belonging to the class of models which Bandura (1986) calls "partially-bidirectional, one-sided interactionist." That is, behaviour is seen as a function of the interaction between individual and environmental characteristics, and individual and environment are acknowledged to interact (Figure 6). Thus, individual beliefs about the consequences of behaviour, for example, and environmental characteristics, such as organizational support, social norms and training, influence behaviour, both singly and interactively. The second part of Bandura's characterization, partially-bidirectional, refers to the relationship between individual characteristics and environmental characteristics. IS research clearly indicates the influence of the environment on the individual, for instance in the influence of training on ability (Nelson & Cheney, 1987b) and user involvement on perceived control (Baronas & Louis, 1988). The influence of individual characteristics on the environment has not been tested in IS research.

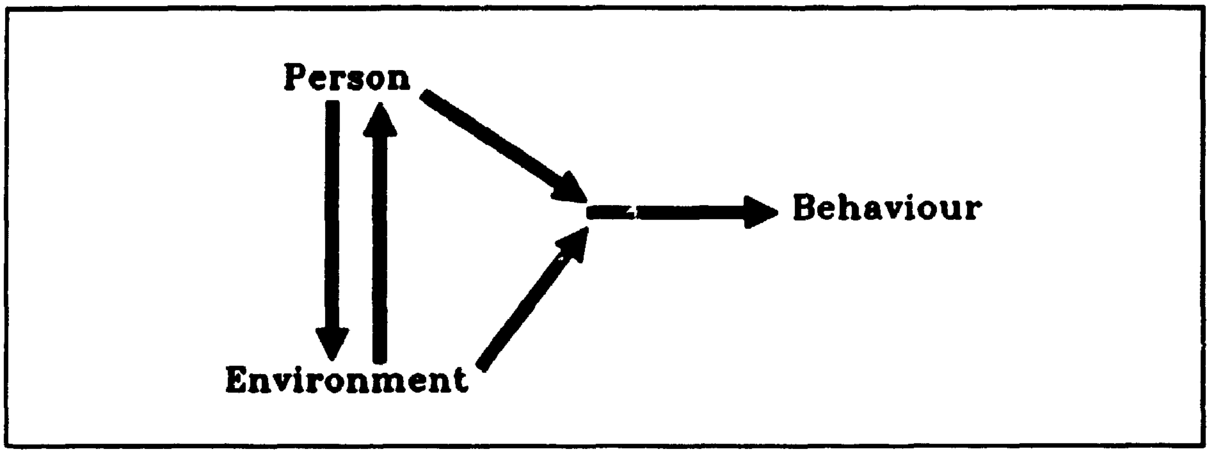


Figure 6. Partially-bidirectional One-sided Interactionist Perspective

Social Cognitive Theory, on the other hand, is based on the premise that environmental influences, individual factors, and behaviour are reciprocally determined. Thus, individuals choose the environments in which they exist, in addition to being influenced by those environments. Furthermore, behaviour in a given situation is affected by environmental or situational characteristics, which are in turn affected by behaviour. Finally, behaviour is influenced by cognitive and personal factors, and in turn, affects those same factors. This relationship, which Bandura refers to as triadic reciprocality or reciprocal determinism, is shown in Figure 7.

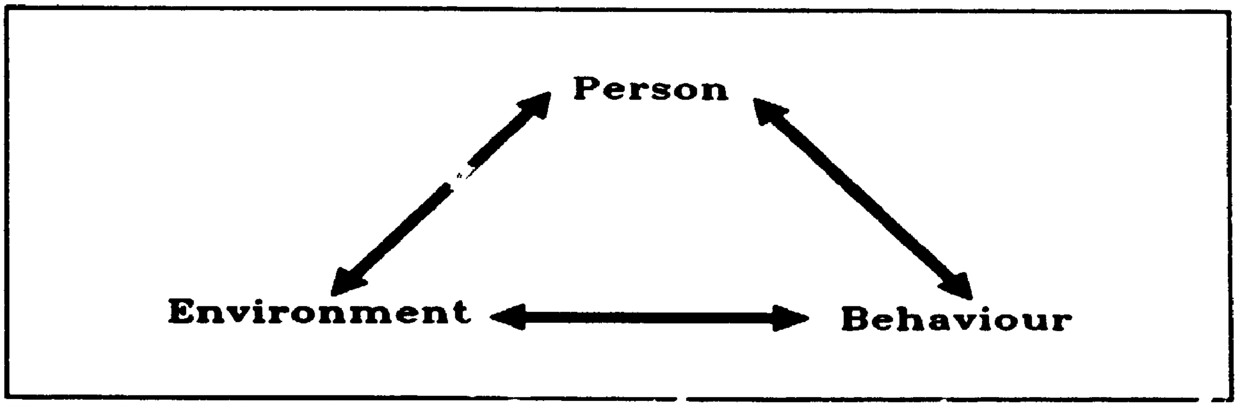


Figure 7. Triadic Reciprocality or Reciprocal Determinism

Social Cognitive Theory, then, might predict that an individual who perceives that the consequences of using computers are favourable (an individual characteristic), would be more inclined to attend computer training (a behaviour). Moreover, by virtue of attending computer training, that individual's perception of the consequences of using computers may be strengthened (behaviour → individual characteristics). Similarly, if others recognize the positive perception of the individual's towards computers, they may become more inclined to favour computer use, and thus a positive social norm is formed (individual characteristic → environment).

Types of Behaviour Explained

The IS research reviewed above, and the theories which have been used to explain IS behaviour, focus primarily on behaviour choice as a dependent variable. The studies are concerned with understanding how individual and environmental characteristics influence the decision to adopt technology and the degree to which it is used. The predominance of use as a dependent variable is an indication of this focus on choice.

Understanding why an individual decides to use a computer, or to use it to a great degree, is without doubt, an important research goal. However, if research is to assist in fostering the *productive* use of technology, it is also necessary to examine the determinants of individuals' computer usage skills (performance). The theories used in IS research, however, provide few insights into these issues.

Social Cognitive Theory, on the other hand, can be used to explain performance as well as choice. According to Social Cognitive Theory, individuals acquire skills through several means. Chief among these is observational learning.

Bandura (1986) states that:

> most human behavior is learned by observation through modeling. By observing others, one forms rules of behavior, and on future occasions this coded information serves as a guide for action ... The capacity to learn by observation enables people to expand their knowledge and

> skills on the basis of information exhibited and authored by others. (p. 47)

Social Cognitive Theory researchers have examined skill acquisition in a number of contexts. Research in this area is mostly experimental, and examines the development of a wide variety of behaviours or skills, including selling skills (Meyer & Raich, 1983), supervisory skills (Byham, Adams & Kiggins, 1976; Davis & Mount, 1984; Goldstein & Sorcher, 1974; Latham & Saari, 1979; Moses & Ritchie, 1976), and mathematics abilities (Schunk, 1981). Much of this research focuses on the use of behaviour modeling, a process in which individuals learn, in part, through the observation of others, as an aid to learning. In addition, the role of actual performance attainments on subsequent learning is studied.

Cognitive Variables

The final difference between IS research and theories on computing behaviour and Social Cognitive Theory is the individual expectancies considered. Information systems research has focused tremendous attention on the perceived consequences of behaviour (what Bandura calls outcome expectations) and has virtually ignored the role of self-perceptions, especially self-perceptions of ability, in shaping behaviour. Triandis incorporates self-perceptions, but only in terms of whether a behaviour is appropriate to the individual's social role (e.g., is it appropriate for a manager to use a computer?). While Porter and Lawler's (1968) revision of expectancy theory includes perceptions that expending a particular degree of effort will lead to performance, the effort-performance relationship is only a small part of the concept of self-efficacy (Bandura, 1986, p.231).

In the Social Cognitive Theory perspective, outcome expectations are but one of two central determinants of behaviour. Social Cognitive Theory recognizes the role of perceived consequences of the behaviour, but also incorporates expectations about personal efficacy. Self-efficacy is defined as "a judgment of one's ability to execute a particular behavior pattern" (Bandura, 1978, p. 240). According to Bandura (1977), self-efficacy, in addition to outcome expectations, must also be considered, since:

> Individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behavior. (p. 193)

Summary

Social Cognitive Theory is a comprehensive theory, incorporating the interactive nature of the primary variables in organizational behaviour. Moreover, it is "complementary, rather than competitive with previous approaches" (Davis & Luthans, 1980, p. 282), encompassing both behaviouristic approaches, such as Skinner's Operant Reinforcement Theory, and cognitive approaches, such as Vroom's Expectancy Theory and Fishbein's Theory of Reasoned Action. In terms of IS research, then, Social Cognitive Theory does not represent a threat to existing perspectives. Rather, it suggests ways in which those perspectives can be refined and enhanced to provide a more complete understanding of individual reactions to computing technology.

IV. Key Elements of Social Cognitive Theory

Of the three differences between Social Cognitive Theory and existing theories of computing behaviour discussed above, the two with the greatest promise to aid information systems research are: (1) the broadened conception of cognitive factors influencing behaviour, specifically the concept of self-efficacy, and (2) the Social Cognitive Theory perspective on how new skills and behaviours are acquired, and in particular, the role of behaviour modeling as a means of developing new skills. These two key dimensions of Social Cognitive Theory form the basis for the current research, and are thus discussed in more detail below.

Self-efficacy

The self-efficacy construct occupies a central role in Social Cognitive Theory. Self-efficacy perceptions are viewed as exerting an influence on many aspects of behaviour, including choice, persistence and performance. Moreover, consideration of self-efficacy perceptions is one of the key features distinguishing Social Cognitive Theory from other theories of individual behaviour. This section considers the definition of self-efficacy, and its implications for constructing self-efficacy measures. The role of self-efficacy, or its influence on behaviour, is also discussed, as are the forces which help shape judgments of self-efficacy.

Defining Computer Self-efficacy

Bandura (1978) defined self-efficacy as "a judgment of one's ability to execute a particular behavior pattern" (p. 240). This definition is expanded by Bandura (1986), as:

> people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses. (p. 391)

This definition highlights two key aspects of the self-efficacy construct. First, self-efficacy judgments refer to future events. Self-efficacy measures expectations about what one could do, rather than statements about what one has done in the past.

Second, the definition indicates the importance of distinguishing between component skills and the ability to "organize and execute courses of action." For example, in discussing driving self-efficacy, Bandura (1984) distinguishes between the component skills and the behaviours one can accomplish:

> in measuring driving self-efficacy, people are not asked to judge whether they can turn the ignition key, shift the automatic transmission, steer, accelerate and stop an automobile, blow the horn, monitor signs, read the flow of traffic and change traffic lanes. Rather they judge, whatever their subskills may be, the strength of their perceived self-efficaciousness to navigate through busy arterial roads, congested city traffic, onrushing freeway traffic, and twisting mountain roads " (Bandura, 1984, p. 233).

Similarly, Collins (1985) distinguishes between the component skills of mathematics (choice of operations and basic arithmetic skills) and mathematics behaviours (solving particular word problems).

The concept of self-efficacy, while it represents a unique construct, bears some similarity to a number of other motivational constructs, such as effort-performance expectancy (Porter & Lawler, 1968), locus of control, and self-esteem. Gist (1987) and Frayne (1986) provide detailed discussions of the similarities and difference between self-efficacy and other motivational constructs.

In defining self-efficacy, it is also important to consider the relevant dimensions of self-efficacy judgments. Self-efficacy judgments differ in their magnitude, strength and generalizability. The *magnitude* of self-efficacy refers to the level of task difficulty one believes is attainable. Individuals with a high magnitude of self-efficacy will see themselves as able to accomplish difficult tasks, while those with a low self-efficacy magnitude will see themselves as only able to execute simple forms of the behaviour. Self-efficacy *strength* refers to the level of conviction about the judgment. It also reflects the resistance of self-efficacy to apparently disconfirming information (Brief & Aldag, 1981). Individuals with a weak sense of self-efficacy will be frustrated more easily by obstacles to their performance and will respond by lowering their perceptions of their capability. By contrast, individuals with a strong sense of efficacy will not be deterred by difficult problems, will retain their sense of self-efficacy, and as a result of their continued persistence are more likely to overcome whatever obstacle was present. *Generalizability* of self-efficacy indicates the extent to which perceptions of self-efficacy are limited to particular situations. Some individuals may believe they are capable of performing some behaviour, but only under a particular set of circumstances, while others might believe they can execute the particular behaviour under any circumstances, and also perform behaviours which are slightly different.

The final issue in defining self-efficacy concerns the specificity of the concept. Expectations about personal efficacy are specific to a particular behaviour. For example, although an individual may have high expectations about his or her ability to persuade others to follow a vision for an organization, high self-efficacy in this domain will have little impact on the expectation that he or she can, for example, learn a foreign language. Thus, self-efficacy must be defined in the particular context to which it is applied.

Computer self-efficacy, then, refers to *a judgment of one's capability to use a computer in the accomplishment of a job task*. It is not concerned with what one has done in the past, but rather with judgments of what could be done in the future. Moreover, it does not refer to simple component subskills, like formatting diskettes or entering formulas in a spreadsheet. Rather, it incorporates judgments of the ability to apply those skills to job tasks (e.g., preparing written reports or analyzing financial data).

Magnitude. The magnitude of computer self-efficacy can be interpreted to reflect the level of capability expected. Individuals with a high computer self-efficacy magnitude might be expected to perceive themselves as able to accomplish more difficult computing tasks than those with lower judgments of self-efficacy. Alternatively, computer self-efficacy magnitude might be gauged in terms of support levels required to undertake a task. Individuals with a high magnitude of computer self-efficacy might judge themselves as capable of operating with less support and assistance than those with lower judgments of self-efficacy magnitude.

Strength. The strength of a computer self-efficacy judgment refers to the level of conviction about the judgment, or the confidence an individual has regarding his or her ability to perform the various tasks discussed above. Thus, not only would individuals with high computer self-efficacy perceive themselves as able to accomplish more difficult tasks (high magnitude), but they would display greater confidence about their ability to successfully perform each of those behaviours.

Generalizability. Self-efficacy generalizability reflects the degree to which the judgment is limited to a particular domain of activity. Within a computing context, these domains might be considered to reflect different hardware and software configurations. Thus, individuals with high computer self-efficacy generalizability would expect to be able to competently use different software packages and different computer systems, while those with low computer self-efficacy generalizability would perceive their capabilities as limited to particular software packages or computer systems.

Role of Self-efficacy

Self-efficacy is a powerful force which influences behaviour in many ways (Bandura, 1986). The following paragraphs review the influences of self-efficacy on behaviour choice, effort and persistence, emotional reactions, and performance attainments.

First, self-efficacy affects choice behaviour. Individuals are much more likely to engage in behaviours that they feel confident in performing, than in behaviours they do not feel they can successfully master. Betz and Hackett (1981) found that the self-efficacy perceptions of college undergraduates regarding various occupations influenced the range of occupations they considered. Bandura, Adams and Beyer (1977) found that subjects with low self-efficacy regarding snakes avoided many outdoor activities. Six months following a treatment to increase self-efficacy perceptions, however, the subjects' participation in these activities had increased significantly. Within a computing context, Hill, Smith and Mann (1986 & 1987) found that students with high computer self-efficacy were more likely to enrol in courses involving the use of computers and to adopt a new computer system.

Self-efficacy also affects the effort exerted in attempting a particular behaviour and the level of persistence in the face of obstacles. Individuals who see themselves as highly efficacious will exert more effort and persist longer, because they believe that ultimately, they will be successful. On the other hand, individuals with low self-efficacy will not try as hard and will give up more easily, because they believe the effort is futile. Brown and Inouye (1978) found that self-efficacy was significantly related to persistence in solving difficult or unsolvable word problems. Similarly, Barling and Beattie (1983) found that sales people with a high sense of self-efficacy were more persistent than their less confident counterparts.

In addition to its influence on choice behaviour and persistence, self-efficacy affects the thought patterns and emotional reactions of the individual. Individuals with low self-efficacy will experience high levels of stress when attempting to perform the relevant behaviour (Bandura et al., 1977), and this level of stress and anxiety may undermine their ability to perform successfully (Bandura, 1986). Bandura, Taylor, Williams, Mefford, and Barchas (1985) found that self-efficacy perceptions were related to stress reactions in the anticipation and performance of fearsome tasks. Secretion of catecholamines, the hormone which mediates such physiological stress reactions as increased heart rate and increased blood pressure, was found to be significantly related to individuals' self-efficacy regarding spiders.

Finally, self-efficacy affects the actual performance attainments of the individual with respect to the behaviour. Locke, Lee and Bobko (1984) found that self-efficacy perceptions were a significant predictor of performance on an experimental task involving naming uses for objects. Schunk (1981) showed that self-efficacy perceptions influenced performance in mathematics. A link between self-efficacy and performance has also been demonstrated in field studies of sales performance (Barling & Beattie, 1983) and research productivity (Taylor, Locke, Lee & Gist, 1984).

Sources of Self-efficacy Information

Individuals rely on four sources of information in forming their self-efficacy judgments (Bandura, 1986). Self-efficacy judgments are continually evaluated and revised on the basis of one's own performance (enactive mastery), observations of the performance of others (vicarious experience), persuasion from others about one's capabilities (verbal persuasion), and internal physiological states (physiological states).

Enactive mastery.

Enactive mastery is the most powerful source of efficacy information. It refers to the information derived from success or failure in the actual performance of the behaviour. Repeated success in using a computer would thus increase computer self-efficacy, while repeated failures would lower it, if success or failure is perceived to be the result of ability rather than effort or other external circumstances.

A number of studies have demonstrated the influence of previous experience on self-efficacy (Gist, 1986; Locke et al., 1984; Stumpf, Brief & Hartman, 1987; Taylor et al., 1984). Clinical research also supports this relationship, providing strong evidence of the influence of mastery on reducing phobic behaviour. Studies of behaviour change have found that providing individuals with the opportunity to successfully perform the target behaviour influences their self-efficacy and their subsequent performance. Thus, snake phobics who are guided through a series of increasingly challenging encounters with snakes become more efficacious and are therefore subsequently more able to cope with the previously threatening reptiles.

Similarly, a staged program of coping for agoraphobics, where they travel progressively further from home and deal successfully with increasingly fearful situations, has been shown to increase their sense of self-efficacy and eliminate their fearful behaviour (Bandura, Adams, Hardy & Howells, 1980).

While mastery is a powerful source of information from which self-efficacy judgments are formed, it is important to note that it is the individuals' interpretation of that performance that influences self-efficacy.

> A distinction must, therefore, be drawn between information conveyed by environmental events and information as selected, weighted, and integrated into self-efficacy judgments. A host of factors, including personal, social, situational, and temporal circumstances under which events occur, affect how personal experiences are cognitively appraised. For this reason, even noteworthy performance attainments do not necessarily boost perceived self-efficacy. (Bandura, 1986, p. 401)

Vicarious experience. Vicarious experience, or the observation of others performing the behaviour, is the second source of self-efficacy information. Observing the success or failure of others attempting to perform particular behaviours will contribute to an individual's beliefs about his/her own capabilities. While vicarious experience is not as powerful as enactive mastery, it can have a substantial impact on self-efficacy perceptions, especially when the observer has little prior experience on which to base an evaluation of his/her personal competence, and when the model is perceived as fairly similar to the observer in terms of age, capability and other personal characteristics (Bandura, 1986).

Two studies have demonstrated the power of vicarious experience as a determinant of self-efficacy. Bandura et al. (1977) compared the relative influence of actual experience (through guided mastery) and vicarious experience (through behaviour modeling) on the development of self-efficacy among people suffering from fear of snakes. Subjects were assigned to one of three groups for the experiment. The first group engaged in participant modeling (or guided mastery), by performing a series of tasks (e.g., touching a snake, holding a snake for a short time) which increased in difficulty. Protective conditions (such as gloves and visors) were available to the subjects at the start, but were removed as they became more confident. The second group simply observed the therapist engaging in the series of graduated activities, for the same length of time as those in the mastery group. A third group, the control group, received no training. At the end of the training period, the subjects' self-efficacy was assessed. The results indicated that subjects in the guided mastery group developed the highest sense of self-efficacy, but that both mastery and modeling, or actual and vicarious experience, were successful in raising self-efficacy.

Schunk (1981) also assessed the influence of vicarious experience through modeling on the development of self-efficacy in the area of mathematics achievement. Fifty-six children who had difficulty in mathematics participated in an experiment to examine the influence of modeling. The results indicated that those children who had observed adult models solving mathematics problems, while talking aloud about the process involved in their solution, had a higher sense of self-efficacy than a control group who received no instruction.

Verbal persuasion. Verbal persuasion is the third form of efficacy information. Bandura (1986) argued that individuals rely, in part, on the opinions of others in forming judgments about their own abilities. Thus, coaching and evaluative feedback on performance increase self-efficacy, if the evaluator is perceived as credible. "The more believable the source of information about one's performance capabilities and task demands, the more likely are judgments of personal efficacy to change" (Bandura, 1986, p. 406). On its own, persuasion may be somewhat limited in its power, except where the heightened performance is attainable through extra effort. Then, the feelings of high self-efficacy will tend to encourage individuals to exert the extra effort, and achieve the higher goal.

Physiological states. Finally, physiological states can provide information about self-efficacy. The physiological arousal that accompanies stressful situations is often interpreted as an indication of inefficacy and thus can cause a re-evaluation of self-efficacy perceptions. In terms of learning, the anxiety that an individual with low self-efficacy feels interferes with the process of learning. The individual is so convinced that he/she cannot learn the behaviour that he/she is unable to properly process the information presented, and learning is impeded. Thus, low self-efficacy, if not recognized and dealt with, is a self-fulfilling prophecy.

Self-efficacy and Computing Behaviour

A small number of studies have examined the influence of self-efficacy on the use of computers. Burkhardt and Brass (1990) conducted a longitudinal study of the factors which influence early adoption of computer technology. Self-efficacy was one of three factors (the others were training and attitude) that were significantly related to early adoption. Hill et al., (1986) examined the relationship between self-efficacy and perceptions about computing technology among college students. The subjects in their study reported higher liking of products for which they felt higher self-efficacy. A second study by the same authors (Hill et al., 1987) indicated that computer self-efficacy perceptions predicted enrolment in a computer course. Two studies (Gist et al., 1989; Webster & Martocchio, in press) have demonstrated the importance of self-efficacy as a predictor of training performance for a Lotus 1-2-3 course.

Summary

Self-efficacy is a complex cognitive force influencing individual behaviour. It influences both our choice of behaviour, our persistence, and our performance attainments. It is shaped over time by our experiences and our observations of others in the world around us. Altering self-efficacy perceptions is, consequently, a difficult task. Understanding the role of self-efficacy in individual reactions to computing technology and its development was, thus, a central goal of this research.

Perspective on Skill Acquisition

The second aspect of Social Cognitive Theory which was especially relevant for this research is the focus on the acquisition of skills. Information System research, to date, has focused almost exclusively on understanding individual choice with respect to computing technology, and has virtually ignored the issues of skill development, or skill acquisition, and performance. While a small number of studies (e.g., Bostrom et al., 1990; Webster et al., 1990) have examined skill development, they have only scratched the surface of these difficult issues.

Part of the reason for the lack of research in this area may be the inability of the theoretical models currently being used to explain skill development, as noted above. Expectancy Theory, the Theory of Reasoned Action, Triandis' theory of behaviour or Diffusion of Technology theory all focus primarily on choice behaviour, and thus do not provide an adequate foundation for studying the processes by which people learn new skills. Social Cognitive Theory, on the other hand, places a great deal of emphasis on the acquisition of behaviours. Much of the research within this paradigm focuses on the experimental induction of self-efficacy expectations and the influence of these expectations on subsequent performance of novel behaviour. For example, the clinical studies on phobias emphasize the development of new behaviours with respect to the subjects' phobias (Bandura et al., 1977; Bandura et al., 1980). Similarly, Schunk's (1981) work on self-efficacy and achievement focused on developing competence in mathematics.

Two primary treatments have been used to influence self-efficacy. Programs of guided mastery, in which the subjects attempt increasingly challenging behaviours with the assistance and support of a coach, provide enactive mastery experiences. Since mastery is a powerful source of efficacy information, these treatments have been highly successful (Bandura et al., 1980). The second major category of treatment, behaviour modeling, makes use of the process of vicarious experience to enhance self-efficacy and performance. Participants in behaviour modeling observe the performance of one or more live or taped models, and learn from these observations (Bandura, 1986).

While guided mastery has been shown to have a stronger influence on self-efficacy, a modeling approach was the preferred approach for this study. Guided mastery, in its pure form, requires a one-on-one interaction between the subject and a coach, in order to ensure that the subjects' experiences are positive. Modeling training, on the other hand, can be done with larger groups of people, as Latham & Saari (1979) showed. Thus, modeling is of greater practical value in training computer skills. The following section discusses the research evidence with respect to behaviour modeling in a variety of different domains.

Behaviour Modeling Training

Behaviour modeling has been widely and successfully used within the Social Cognitive Theory paradigm, both to teach new behaviours (assertiveness: Decker, 1980; Mann & Decker, 1984) or skills (mathematics: Schunk, 1981; selling skills:

Meyer & Raich, 1983; supervisory skills: Byham et al., 1976; Davis & Mount, 1984; Goldstein & Sorcher, 1974; Latham & Saari, 1979; Moses & Ritchie, 1976; leadership styles: Manz & Sims, 1986), and to overcome destructive phobias (snake phobia: Bandura & Barab, 1973; Bandura et al., 1977; Bandura, 1982). A recent meta-analysis of the managerial training literature (Burke & Day, 1986) demonstrated the effectiveness of behaviour modeling training both in terms of learning and subsequent behaviour on the job.

In a behaviour modeling training program, participants observe the performance of one or more live or taped models, with or without an accompanying summary of the learning points. By observing the performance strategies of the models, their abilities to perform, and the outcomes of their behaviour, the participants vicariously experience the behaviour before attempting to perform it themselves (Bandura, 1986).

Modeling training has three outcomes. First, observing someone competently performing the new behaviour suggests appropriate and effective strategies for dealing with challenging or threatening situations (Bandura, 1978, 1982). Schunk (1981) used modeling to teach children mathematics skills. Adult models performed division tasks, describing the cognitive operations involved as they went along. This cognitive modeling treatment had a significant impact on subsequent performance, indicating that new skills had been acquired by the subjects from observation of the models' performance.

Modeling is also a source of self-efficacy information, as discussed above (Bandura, 1982). Several studies have demonstrated a significant effect of behaviour modeling on self-efficacy expectations (Bandura et al., 1977; Bandura, 1982; Brown & Inouye, 1978).

Finally, observing the outcomes of the models' performance provides information about the likely consequences of the behaviour. Bandura (1971) studied the influence of modeling and rewards on aggressive behaviour in children. He found that if the model's aggressive behaviour was rewarded, or if no feedback was provided, the children were significantly more likely to engage in subsequent similar aggressive behaviours. However, if the model was punished for the aggressive behaviour, the subjects did not adopt it.

Thus, modeling is a complex phenomenon, encompassing more than pure imitation, which has been demonstrated to be an effective means of altering self-efficacy perceptions and ultimately of contributing to the development of new skills. Understanding the role of modeling within the context of developing computer self-efficacy and skills was the second major goal of this research.

V. Conclusions

The purpose of this research, as noted earlier, was to test the applicability of Social Cognitive Theory to understanding individual reactions to computing technology. More specifically, the research sought to understand the role of self-efficacy in influencing a variety of individual reactions (including emotional responses, choice behaviour and performance) and to assess the potential of behaviour modeling as a means of influencing computer self-efficacy perceptions and computing skills.

Two related studies were conducted as the means toward achieving these goals. The first was a national survey of managers and professionals regarding their feelings toward and use of computers. This survey formed the basis for an initial validation of a new measure of computer self-efficacy. In addition, the survey was used to assess the consequences and antecedents of self-efficacy and outcome expectations in an information technology context.

The second study was a laboratory experiment in which managers and professionals were taught to use two software packages through either traditional methods (lecture and practice), or traditional methods plus behaviour modeling. The purpose of the experiment was threefold. It was intended to examine whether self-efficacy and outcome expectations would influence performance in the use of computers. In addition, it sought to test whether training was a useful means of altering self-efficacy and outcome expectations and, in particular, whether the addition of a behaviour modeling intervention would add to gains in self-efficacy, outcome expectations and performance.

The two studies are described in Chapters Three (the survey) and Four (the experiment). The specific research models and hypotheses tested for each study are presented in those chapters, along with the details of the methodologies and the results.

CHAPTER THREE - STUDY 1: THE SURVEY

I. Overview

The purpose of this phase of the research was threefold. First, it provided the means to develop and validate a measure of computer self-efficacy which could be used in later research. Second, it provided the opportunity to test a model of behaviour choice based on Social Cognitive Theory within the Information Systems context. Third, a follow up questionnaire one year later provided the basis for a longitudinal assessment of the behaviour choice model.

The chapter is organized as follows. In the next section the development of the self-efficacy measure is discussed. The initial survey is described in the third section of the chapter. The research model to be tested, and the specific hypotheses are presented first, followed by a description of the methodology used in the study and the results of the initial questionnaire. The fourth section of the chapter describes the follow up survey. Changes and additions to the hypotheses and research methodology are discussed first, followed by the presentation of the results. The chapter concludes with a discussion of the implications of these findings, and the strengths and limitations of the research.

II. Development of a Computer Self-efficacy Measure

The first step in carrying out the survey was the development of a measure of computer self-efficacy. Only five previous studies had measured self-efficacy in a computing context, and a review of these measures indicated that none adequately captured the construct as defined by Bandura (1986).

The definition of self-efficacy, discussed in detail in Chapter Two, indicates a number of concerns in forming a measure of computer self-efficacy. The measure, in order to be consistent with Bandura's definition of the construct, must be task focused. That is, it must focus on tasks which require the use of computers, rather than the use of computers as an end in itself. In addition, it must address all three of the relevant dimensions of self-efficacy (magnitude, strength and generality) and must be tailored to the domain of interest.

Different levels of difficulty must be incorporated into a computer self-efficacy measure to adequately capture self-efficacy *magnitude*. To capture the dimension of self-efficacy *strength*, a response scale which explicitly considers the individuals' level of confidence in judging their capabilities is required. Self-efficacy *generalizability*, unlike the other dimensions, is not captured in a single measure. Rather, it is measured by gathering data about different specific domains (Bandura et al., 1980). Thus, it is important to construct a measure which can be used across many different domains of computing, rather than one which can only apply at a specific level of generality. This approach to measuring generalizability is also consistent with the concerns about the relevant domain. If the measure can be used to reflect a variety of specific domains, then the appropriate level of specificity can be used for any particular research context.

Previous Approaches to Computer Self-efficacy Measurement

A review of the literature concerning self-efficacy and computers uncovered five existing measures (Appendix A). Evaluation of these measures, in terms of how they addressed the nature and dimensions of self-efficacy, showed that none of the measures was entirely adequate for the intended purposes. Table 1 summarizes these measures with respect to the important aspects of measurement described above. The authors' names and construct names are shown in the first and second columns. The third column indicates whether the measure is task focused, rather than reflecting component skills or some other construct. The next two columns describe whether the magnitude and strength dimensions of self-efficacy are captured by the measures. The sixth column indicates the level of the measure. For example, a measure which addresses self-efficacy for computers overall would be considered general, while one that examined a particular software package would be considered specific. The final column indicates whether the measure could be adapted to other domains.

Burkhardt and Brass (1990) utilized a three item scale to measure computer self-efficacy in a study of the early adoption of computing technologies. Their measure satisfied most, but not all, of the measurement criteria. Self-efficacy magnitude was not captured by the measure, since only general perceptions about computers were sought. Self-efficacy strength, or the degree of confidence in the judgment of capability, was only weakly assessed. A 7 point Likert response scale, ranging from strong disagreement to strong agreement, was used in the measure. While degrees of agreement could be interpreted to reflect confidence in the

Table 1
Summary Analysis
of
Computer Self-efficacy Measures

Authors	Construct Name	Task Focus	Magnitude	Strength	Generalizability	
					Level	Adaptable
Burkhardt & Brass (1990)	Computer Self-efficacy	YES	NO	WEAK	GENERAL	YES
Hill, Smith & Mann (1987)	Computer Self-efficacy	NO	NO	WEAK	GENERAL	NO
Webster & Martocchio (1990)	Software Efficacy	NO	NO	WEAK	SPECIFIC	YES
Gist, Schwoerer & Rosen (1989)	Computer Self-efficacy	NO	YES	YES	MIXED	NO
Gist, Schwoerer & Rosen (1989)	Software Self-efficacy	NO	YES	YES	SPECIFIC	NO

judgment, a more direct response scale, such as NOT AT ALL CONFIDENT to TOTALLY CONFIDENT would provide a better indication of self-efficacy strength.

Hill et al. (1987) studied the influence of computer self-efficacy on enrolment in a computer course. They used a four item scale, revised from a scale used in an earlier study (Hill et al., 1986). Their measure fell short on all of the criteria. First, it was not task focused. Three of the items measured general perceptions about the nature of computing, such as "only a few experts really understand how computers work." Responses to these statements may or may not reflect computer self-efficacy. Self-efficacy magnitude was not assessed, and strength could only be inferred from the strength of agreement, as was the case for the Burkhardt and Brass measure. Finally, the questions were posed at a general level, and could not be easily tailored to reflect other, more specific domains.

Webster and Martocchio (1990, & in press) studied the influence of computer self-efficacy on training performance. They developed a five item scale to measure software efficacy. This measure did not meet the criteria of task focus. It focused on the ability to use a specific software feature (WordPerfect merging), rather than the accomplishment of a job task (for example, creating a form letter using WordPerfect merging). Self-efficacy magnitude was not captured by the measure, and strength was again reflected only indirectly.

Gist et al. (1989) studied the relationship between computer self-efficacy, computer training methods, and training performance. They developed two measures relating to self-efficacy. The first concerned the general construct, computer self-efficacy. The second focused on a measure specific to using a spreadsheet package. Neither of the measures could be considered task focused. Many of the items used reflected component skills, the ability to use specific software features, rather than the potential to use the software in the accomplishment of a task. The computer self-efficacy measure was framed in general terms while the software self-efficacy measure was geared specifically towards the spreadsheet package. However, neither scale could be easily tailored to other domains (e.g., other types of software) or different levels. Thus, these measures, like the others, did not entirely satisfy the measurement criteria.

This examination of existing measures of computer self-efficacy indicated the need for additional development work. Most measures focused on component skills of behaviour rather than assessments of one's ability to carry out some task and are thus an inadequate reflection of self-efficacy. Self-efficacy magnitude was assessed in only two of the measures, strength was weakly assessed, and only two of the measures could be applied to other domains.

The Current Approach to Measurement

In developing a new measure of computer self-efficacy, reference was made to the existing measures, in particular the works of Gist et al., (1989), Webster and Martocchio (1990, in press) and Burkhardt and Brass (1990). While none of these

The research model encompasses fourteen hypotheses regarding individual reactions to computing technologies. These hypotheses represent specific instances of the sources of self-efficacy information and role of self-efficacy, discussed in detail in Chapter Two. The following paragraphs restate the theoretical rationale for each of these hypotheses. Empirical evidence from both the Social Cognitive Theory and Information Systems literature is used to reinforce these arguments.

Encouragement by Others

The encouragement of others within the individual's reference group can be expected to influence both self-efficacy and outcome expectations. Encouragement of use represents "verbal persuasion," one of the four major sources of efficacy information (Bandura, 1986). Individuals rely, in part, on the opinions of others in forming judgments about their own abilities. Thus, encouragement from others influences self-efficacy, if the source of encouragement is perceived as credible (Bandura, 1986). The related hypothesis is:

> **H1. The higher the encouragement of use by members of the individual's reference group, the higher the individual's self-efficacy.**

Encouragement of use may also exert an influence on outcome expectations. If others in the reference group, particularly those in the individual's work organization, encourage the use of computing technology, the individual's judgments about the likely consequences of the behaviour will be affected. At the very least, the individual will expect that his or her coworkers will be pleased by the behaviour. Thus, the second hypothesis of the research is as follows:

In this manner, the measure maintains a task focus, and considers the ability to generate novel responses rather than a fixed pattern of response. Respondents are not asked whether they believe they could accomplish a specific range of computer tasks, but rather whether they believe they could cope with an unfamiliar technology. Discussions with computer users and IS professionals indicated that it was this ability to deal with the unfamiliar - either the adoption of new technology, or the use of new features of current software - which truly separated individuals with high and low self-efficacy.

Magnitude

In order to capture self-efficacy magnitude, the approach taken by Gist et al. (1989) was adopted. Their measure consisted of five items reflecting self-efficacy on some aspect of computer operation. Each of the five items incorporated different levels of assistance for computer use to reflect different levels of difficulty. These levels of assistance were extended and refined, and incorporated into the measure in order to capture computer self-efficacy magnitude. The result was ten conditions under which a person might be trying to accomplish something with a new software package. This approach is similar to that taken by Frayne and Latham (1987) in measuring attendance self-efficacy, and by Condiotte and Lichenstein (1981) and Diclemente (1981) in measuring self-efficacy concerning smoking cessation.

Strength

The strength of self-efficacy judgments is captured in the response scale. The scale used in this measure is taken from measures developed by Bandura (e.g., Bandura et al., 1977; Bandura et al., 1980). Respondents are asked to indicate first whether they believe they could accomplish the task using the computer (yes or no), and if yes, their confidence that they could do so. The variations in confidence represent the measure of self-efficacy strength.

Generalizability

In order to capture self-efficacy generalizability, the measure had to be adaptable to different domains of computer use. The scales used by Webster and Martocchio (1990, & in press) and Burkhardt and Brass (1990), both of which could be easily adapted to other domains of computer use, were used as a guide in this aspect of the measure development. For study one (the survey), the generalized form of the measure was used - that is, the measure was not confined to a particular computing domain. However, the measure could be framed in terms of a very specific software package for a specific job task, thus resulting in a domain specific measure of self-efficacy. This approach was, in fact, adopted in study two and will be discussed in more detail in Chapter Four.

III. Initial Questionnaire

Research Model and Hypotheses

The research model tested in this phase of the study (Figure 8) was developed with reference to the Social Cognitive Theory literature, and the existing base of research in the information systems literature. As noted in Chapter Two, the theory holds that individual factors, environmental influences and behaviour are engaged in an ongoing reciprocal relationship. While the richness of this conceptualization cannot be completely conveyed in a linear, recursive model, important insights into the relationships among such variables can be achieved nonetheless.

Elements of all three forces were incorporated into the research model. The choice of which specific elements to include for each factor was based on existing IS research. Thus, the model helps to integrate the findings from previous IS research by considering several key constructs within the context of Social Cognitive Theory.

Self-efficacy and outcome expectations form the central cognitive mechanisms in the model. The self-efficacy construct was derived directly from the Social Cognitive Theory literature. The outcome expectations construct draws on both Social Cognitive Theory and on previous IS research which considered similar constructs.

In terms of behaviour, the model focused exclusively on behaviour *choice* -- whether and to what extent computers are used. Performance issues (e.g., how skilled were the respondents) were not addressed in this study in order to avoid

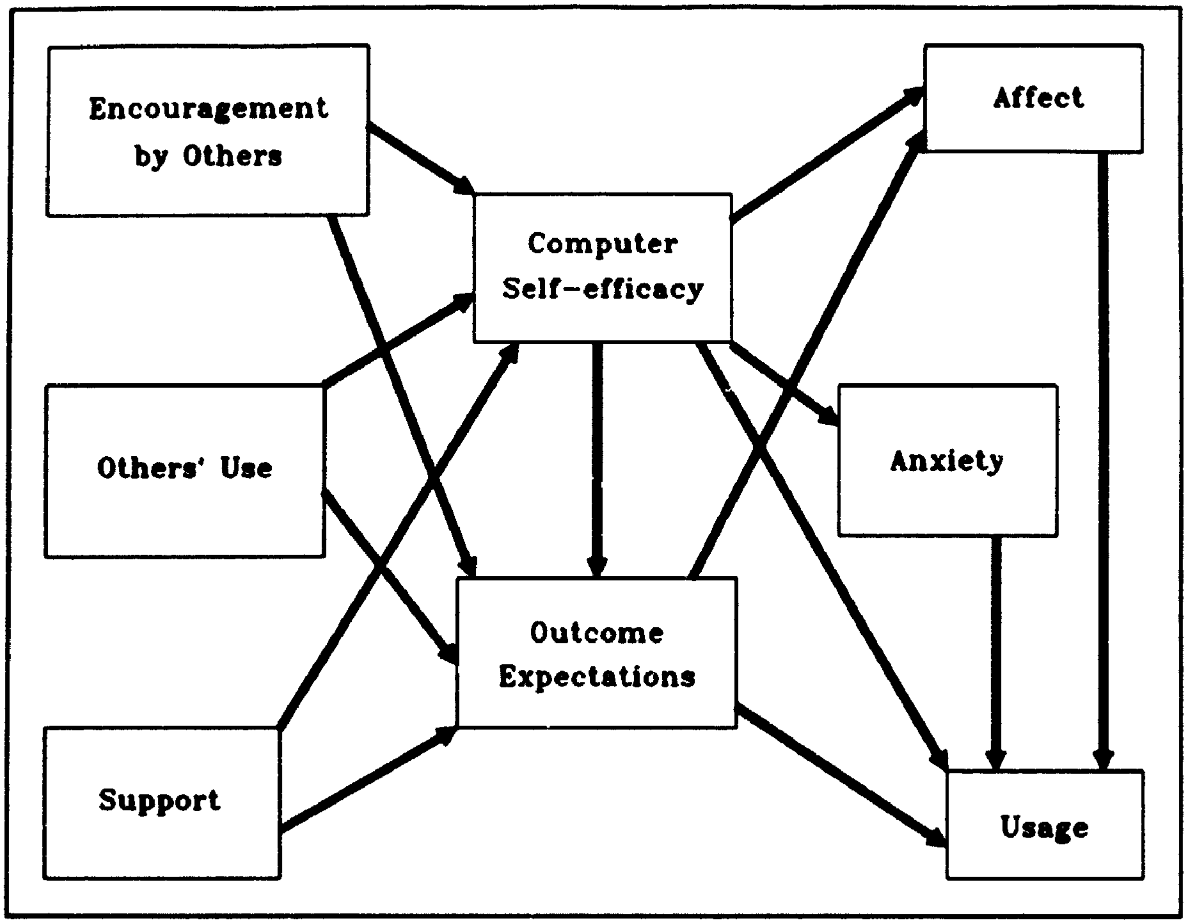


Figure 8. Research Model

problems of discriminant validity between self-reports of ability and self-efficacy.

Two additional reactions were also assessed in the model: positive affect for computer use[2] and computer anxiety. According to Social Cognitive Theory, both affect (or liking) and anxiety may be influenced by an individuals' self-efficacy and outcome expectations. Previous IS research has demonstrated that affect and anxiety can exert an influence on behaviour (e.g., Igbaria, 1990). Thus, combining these

---

[2] The term affect is used throughout this study to refer to positive affect. Negative affect was not investigated.

perspectives, affect and anxiety can be viewed as partial mediators of the relationship between self-efficacy and use and between outcome expectations and use.

Three environmental influences were incorporated into the model. The extent to which use was encouraged by others in the environment, the degree to which computers were used by others in the environment, and the availability of support from the respondents' organizations were believed to represent important sources of information on which efficacy and outcome expectations could be formed.

According to the model, outcome expectations and self-efficacy are the two primary cognitive forces guiding choice behaviour (i.e., computer usage in the present study). In other words, individuals' beliefs about the likely consequences of their actions and their judgments of their capability to execute those actions, are important determinants of behaviour choice. Emotional responses, such as affect and anxiety, are also considered to be a function of judgments about self-efficacy and outcome expectations, and are also viewed as influencers of use. Judgments of self-efficacy and outcome expectations are influenced by many factors, including environmental characteristics. In particular, Social Cognitive Theory advances observational learning as a means of forming efficacy and outcome expectations. Encouragement by others, others' actual use and organizational support are all components of observational learning. Thus, all three are considered important determinants of self-efficacy and outcome expectations.

The research model encompasses fourteen hypotheses regarding individual reactions to computing technologies. These hypotheses represent specific instances of the sources of self-efficacy information and role of self-efficacy, discussed in detail in Chapter Two. The following paragraphs restate the theoretical rationale for each of these hypotheses. Empirical evidence from both the Social Cognitive Theory and Information Systems literature is used to reinforce these arguments.

Encouragement by Others

The encouragement of others within the individual's reference group can be expected to influence both self-efficacy and outcome expectations. Encouragement of use represents "verbal persuasion," one of the four major sources of efficacy information (Bandura, 1986). Individuals rely, in part, on the opinions of others in forming judgments about their own abilities. Thus, encouragement from others influences self-efficacy, if the source of encouragement is perceived as credible (Bandura, 1986). The related hypothesis is:

> **H1. The higher the encouragement of use by members of the individual's reference group, the higher the individual's self-efficacy.**

Encouragement of use may also exert an influence on outcome expectations. If others in the reference group, particularly those in the individual's work organization, encourage the use of computing technology, the individual's judgments about the likely consequences of the behaviour will be affected. At the very least, the individual will expect that his or her coworkers will be pleased by the behaviour. Thus, the second hypothesis of the research is as follows:

H2. The higher the encouragement of use by members of the individual's reference group, the higher the individual's outcome expectations.

Others' Use

Encouragement of use is one source of influence on self-efficacy and outcome expectations. The actual behaviour of others with respect to the technology is a further source of information used in forming self-efficacy and outcome expectations. Learning by observation, or behaviour modeling, has been shown to be a powerful means of behaviour acquisition (Latham & Saari, 1979; Manz & Sims, 1986; Schunk, 1981). Behaviour modeling influences behaviour in part through its influence on self-efficacy (Bandura et al., 1977) and also through its influence on outcome expectations, by demonstrating the likely consequences of the behaviour (Bandura, 1971). Thus, hypotheses 3 and 4 reflect the influence of the modeling behaviour of others in the individual's reference group:

H3. The higher the use of the technology by others in the individual's reference group, the higher the individual's self-efficacy.

H4. The higher the use of the technology by others in the individual's reference group, the higher the individual's outcome expectations.

Support

The support of the organization for computer users can also be expected to influence individuals' judgments of self-efficacy. The availability of assistance to individuals who require it should increase their ability, and thus their perceptions of their ability. Support can also be expected to influence outcome expectations, as this support reflects the formal stance of the organization towards the behaviour, and thus may provide clues about the likely consequences of using the computer. Thus, hypotheses 5 and 6 are as follows:

> **H5. The higher the support for computer users in the organization, the higher the individual's self-efficacy.**
>
> **H6. The higher the support for computer users in the organization, the higher the individual's outcome expectations.**

Computer Self-efficacy

Social Cognitive Theory affords a prominent role to self-efficacy perceptions. Self-efficacy judgments are purported to influence outcome expectations since "the outcomes one expects derive largely from judgments as to how well one can execute the requisite behaviour" (Bandura, 1978, p. 241). The hypothesis is:

> **H7. The higher the individual's self-efficacy, the higher his/her outcome expectations.**

Self-efficacy judgments are held to have a substantial influence on the emotional responses of the individual. Individuals will tend to prefer and enjoy behaviours they feel they are capable of performing and to dislike those they do not feel they can successfully master. Several studies in psychology provide support for this contention. Betz and Hackett (1981) found that self-efficacy perceptions were significantly related to affect (or interest) for particular occupations. Bandura et al. (1977) and Stumpf et al. (1987) found that individuals experience anxiety in attempting to perform behaviours they do not feel competent to perform. These relationships are predicted by hypotheses 8 and 9, as follows:

H8. The higher the individual's self-efficacy, the higher his/her affect (or liking) of computer use.

H9. The higher the individual's self-efficacy, the lower his/her computer anxiety.

Self-efficacy perceptions are predicted to be a significant precursor to computer use. This hypothesis is supported by research regarding computer use (Burkhardt & Brass, 1990; Hill et al., 1987) and research in a variety of other domains (Bandura et al., 1977; Betz & Hackett, 1981; Frayne & Latham; 1987). While self-efficacy has not been explicitly measured in IS research, there is some evidence to support the influence of self-efficacy. Maish (1979) included a variable which measured the extent to which the user felt "prepared to use" the new system. This variable is conceptually quite similar to self-efficacy, and was found to be related to the degree of use. Similarly, the willingness to change construct measured by Barki and Huff (1990), which in part reflects self-efficacy, was found to be related to use of a decision support system.

H10. The higher the individual's self-efficacy, the higher his/her use of computers.

Outcome Expectations

Outcome expectations also exert a significant influence on individuals' reactions to computing technology. The expected consequences of a behaviour may be construed as an influence on affect (or liking) for the behaviour, through a process of association. The satisfaction derived from the favourable consequences of the behaviour becomes linked to the behaviour itself, causing an increased affect for the behaviour (Bandura, 1986). This gives rise to the following hypothesis:

H11. The higher the individual's outcome expectations, the higher his/her affect (or liking) for the behaviour.

Outcome expectations are also an important precursor to usage behaviour. According to Social Cognitive Theory, individuals are more likely to engage in behaviour they expect will be rewarded (or will result in favourable consequences). Bandura (1971) found support for this contention in a study of aggressive behaviour in children. The hypothesis is also supported by IS research (Davis et al., 1989; Hill et al., 1987; Pavri 1988; Thompson et al., 1991). Thus, the hypothesis is:

H12. The higher the individual's outcome expectations, the higher his/her use of computers.

Affect

Individuals' affect (or liking) for particular behaviours can, under some circumstances, exert a strong influence on their actions. Television preferences, for example, are almost solely based on affect (Bandura, 1986). Consumer choices are also often made on the basis of affective reactions (Engle, Blackwell & Miniard, 1986). With respect to computers, the evidence is not clear. Thompson et al. (1991), for example, found no relationship between affect for PC use and the use of personal computers among managers. However, their measure of affect was weak, and thus the finding may simply be a reflection of the measurement.

Given the theoretical support for such a link and the absence of significant findings, the relationship between an individual's liking for computer use, and his or her actual behaviour, is worthy of further study. Thus, the next hypothesis is:

> **H13. The higher the individual's affect for computer use, the higher his/her use of computers.**

Anxiety

Feelings of anxiety surrounding computers are expected to negatively influence computer use. Not surprisingly, people are expected to avoid behaviours which invoke anxious feelings. A number of studies have demonstrated a relationship between computer anxiety and the use of computers (Igbaria et al., 1989; Webster et al., 1990).

> **H14. The higher the individual's computer anxiety, the lower his/her use of computers.**

Research Design

Measures

A mail survey was constructed incorporating all of the constructs discussed above, as well as demographic information (see Appendix C). Where possible, the scales were taken directly or adapted from existing research. The specific measures used are discussed below.

Computer self-efficacy. Computer self-efficacy was measured by the 10 item scale described earlier. Respondents were asked to indicate whether they felt they could accomplish a job task using a hypothetical software package under a variety of different conditions, and if so, how confident they were that they could do so.

Encouragement by others. The extent to which use of computers was encouraged by others in the individual's reference group was measured by 7 items, developed for this research. Respondents were asked to assess, on a 5 point scale, the extent to which their use of computers was encouraged by: their peers in their work organization, their peers in other organizations, their family, their friends, their manager, other management, and their subordinates.

Others' use. The extent to which computers were actually used by others in the individual's reference group was also assessed using 7 items. Respondents were asked to indicate, on a 5 point scale, the extent to which their peers in their work organization, their peers in other organizations, their family, their friends, their manager, other management, and their subordinates actually used computers.

Support. The organizational support for computer users was measured by six items, drawn from Thompson et al. (1991). The respondents were asked to indicate, on a 5 point scale, the extent to which assistance was available in terms of equipment selection, hardware difficulties, software difficulties, and specialized instruction. They also rated (on the same scale) the extent to which their coworkers were a source of assistance in overcoming difficulties, and their perception of the organization's overall support for computer users.

Outcome expectations. An 11-item measure of outcome expectations was developed based on a review of existing measures in the IS literature. For example, Davis' (1989) measure of usefulness deals primarily with outcome expectations. Similarly, Pavri's (1988) beliefs construct, and three of the constructs used by Thompson et al. (1991) reflect the expected consequences of using a computer. The measure presented a variety of outcomes which might be associated with computer use, including increased productivity, decreased reliance on clerical support, enhanced quality of work output, feelings of accomplishment, and enhanced status. Respondents were asked to indicate, on a 5 point scale, how likely they thought it was that each of these outcomes would result from their use of computers.

Affect. Affect was measured in this study by 5 items drawn from the Computer Attitude Scale (Loyd & Gressard, 1984). Respondents indicated, on a 5 point scale, the extent to which they agreed or disagreed with such items as "I like working with computers," and "Once I get working on the computer, I find it hard to stop."

Anxiety. Anxiety was measured by the 19-item Computer Anxiety Rating Scale (Heinssen, Glass and Knight, 1987). Webster et al. (1990) found this to be a valid scale for measuring computer anxiety.

Use. Computer use was measured by 4 items, reflecting the duration and frequency of use of computers at work, and the duration of use of computers at home on weekdays and weekends.

Procedures

Pretest. A pretest of the questionnaire was conducted with 40 people, including both academics and practitioners. Each of the respondents completed the questionnaire and provided feedback about the process and the measures. Overall, they indicated that the questionnaire was relatively clear and easy to complete. Following the pretest, a number of modifications to the instrument were made, in order to improve the measures and the overall structure of the questionnaire.

Pilot study. One hundred people within a limited geographical area were randomly selected from the sampling frame (discussed below) for the pilot study. The geographical restriction was placed on the sample so that follow up interviews could be conducted with as many of the respondents as possible. The survey was mailed to selected individuals with a cover letter indicating the purpose and importance of the study. A follow up letter was sent to those individuals who had not responded after two weeks.

The pilot study served a number of purposes. First, it provided an opportunity to obtain feedback about the questionnaire from members of the target population. In addition, the data collected in the pilot study were used to make a preliminary assessment of the reliability and validity of the measures, in particular the measure of self-efficacy which was developed specifically for this research. Finally, the pilot study data were used to calculate the expected response rate, required sample size, and thus the appropriate size of the mailing for the main study.

Table 2
Reliability of Measures
(Pilot Study)

MEASURE	NO. OF ITEMS	C. ALPHA
Computer Self-efficacy	10	0.94
Outcome Expectations	11	0.85
Computer Anxiety	19	0.81
Affect	5	0.83

n=55

The measures of Encouragement of Use, Others' Use and Support were added after the pilot study. Thus, no initial reliability data were available.

Sixty-four responses were received from the 100 questionnaires mailed. These responses were used to compute the reliabilities of the scales and to assess the required sample size for the main study. All of the measures displayed adequate reliabilities. (Table 2).

The pilot study data were also used in the calculation of an appropriate sample size for the main study. Power analysis indicated a minimum sample size of 258, based on the preceding information. However, other considerations also weighed in the determination of the ultimate sample size. A variety of complex analyses were planned for the data, including structural equations modeling. In order to provide an adequate data base from which to conduct the planned tests, a sample of at least 500 was considered more appropriate. This figure was doubled to allow a holdback sample to be removed from the data for some of the hypothesis testing. The response rate for the pilot study was 64%. A conservative estimate of the response rate for the main study was 50%, indicating a required mailing of 2000.

Main study. The procedures for the main study mirrored those used in the pilot study. Two thousand people were selected at random from the sampling frame (discussed below). A cover letter explaining the purpose of the study accompanied each survey. Three weeks following the initial mailing, a second letter was sent to those individuals who had not yet responded. This letter stressed the importance of their responses and gave them a number to call if they had any questions or required a new copy of the survey. A copy of the follow up letter can be found in Appendix D.

Sample

The target population for the study was knowledge workers, individuals whose work requires them to process large amounts of information. This category includes most managers, as well as professionals such as insurance adjusters, financial analysts, researchers, consultants and accountants. The subscriber list of a Canadian business periodical was obtained as a sampling frame to reach this population. As noted above, 100 of these subscribers were randomly selected for the pilot study, and 2000 were randomly selected for the main study.

Main study response rate. Of the 2000 surveys mailed, 1022 were completed and returned. Ninety-one were also returned as undeliverable, yielding a response rate of 53.4%. No attempt was made to contact non-respondents, thus non-response bias could not be directly assessed. However, Armstrong and Overton (1977) indicated that a comparison of the responses of the early returns to those returned late could be used to estimate the extent of non-response bias. A multivariate analysis of variance was conducted to determine whether differences in response time (early versus late) were associated with different responses on the eight constructs in the model. The test indicated no significant differences in any of these constructs (Wilks' $\Lambda = 0.97$; $p = .735$). Thus, non-response bias was not considered to be a significant problem.

Main study respondents. The 1022 respondents were mostly male (83%), and had an average age of 41 years. They represented all levels of management, and were evenly split between line and staff positions. They worked in a variety of functional areas including accounting and finance (18%), general management (30%), and marketing (16%). Forty-three percent had completed one college or university degree, and a further 40% had completed post graduate degrees. The respondents' educational backgrounds were in business (61%), arts (10%), and social science (5%).

In terms of their familiarity with and use of computers, the survey respondents ranged from novices who use computers either very little or not at all, to experts who spend most of their time using computers. On average, they consider themselves to be in the mid-range of familiarity (mean overall familiarity = 3.51, S.D. = 1.08). Table 3 shows the average responses to 12 questions which asked them to rate their

Table 3
Means and Standard Deviations of Familiarity Scores
(Main Study)

Item	Mean†	Std. Dev.
FAM1 - Overall Familiarity	3.51	1.08
FAM2 - Apple PCs	1.90	1.23
FAM3 - IBM PCs	3.57	1.24
FAM4 - Minicomputers	2.01	1.23
FAM5 - Mainframes	2.20	1.29
FAM6 - Spreadsheets	3.48	1.33
FAM7 - Word Processing	3.49	1.31
FAM8 - Database Packages	2.50	1.24
FAM9 - Statistics	1.94	1.08
FAM10 - Graphics	2.47	1.31
FAM11 - Electronic Mail	2.73	1.53
FAM12 - Programming Languages	1.89	1.19

† 5 point scale: 1=Not at all Familiar; 5=Very Familiar

n= 1022

familiarity. Not surprisingly, they were most familiar with personal computers and popular PC applications such as word processing and spreadsheets, and less familiar with mainframe or minicomputer systems, and with applications such as data base or programming. These patterns of familiarity suggest that the respondents represent end users of technology rather than technology developers.

Table 4 shows the average responses for use of computers. On average, the respondents were fairly heavy users of computers. The respondents used their computers daily, for between 2 and 4 hours per day. In addition, most used a computer at home on weekdays and weekends, although the average time spent was

Table 4
Means and Standard Deviations of Usage Questions
(Main Study)

Item	Mean	Std. Dev.
USE1 - Hours Used at Work	1.85	1.98
USE3 - Frequency of Use at Work	4.82	1.69
USE5 - Hours Used at Home (weekdays)	0.37	0.79
USE6 - Hours Used at Home (weekends)	0.82	1.43

n= 1022

Response Scale (USE3)
1=Less than once a month; 2=About once a month; 3=A few times a month
4=A few times a week; 5=About once a day; 6=Several times a day

less than 30 minutes.

Data Analysis

Data analysis was conducted using Partial Least Squares (PLS), a relatively new, powerful multivariate analysis technique that is ideal for testing structural models with latent variables (see Wold, 1985 for a comprehensive description). PLS belongs to a family of techniques that Fornell (1984) calls "the second generation of multivariate data analysis techniques." LISREL (Lohmöller, 1988), which stands for Linear Structural Relations, is the best known member of this family.

The primary benefit of using the second generation techniques is the explicit recognition of the fundamental interlinking of theory and data (Bagozzi, 1984). Testing of measures is not artificially separated from testing of theory, and thus a stronger test of both measures and theory is permitted. Structural equations modeling (PLS in this case) has the added benefit of being able to model both direct and indirect relationships among constructs (or latent variables), making it possible to test complex theoretical models.

PLS belongs to the same class of models as canonical correlation, regression, and principal components factor analysis. The path coefficients in a PLS structural model are standardized regression coefficients. The loadings of the items on the constructs from the measurement model are factor loadings. Thus, the results can be interpreted by considering them in the context of regression and principal components analysis.

Examination of the research model proceeded in two phases: (a) assessment of the measurement model, including the reliability and discriminant validity of the measures, and (b) assessment of the structural model. Prior to analysis a randomly selected holdback sample was removed from the data to permit testing of any model revisions.

Item loadings and internal consistency reliabilities were examined as a test of reliability. Discriminant validity was assessed using two methods. First the item loadings were examined to ensure that no item loaded higher on another construct than it did on the construct it was intended to measure. Second, the average variance shared between the constructs and their measures were compared to the variances shared between the constructs themselves.

Results

Construct Validity

The factor structure matrix (Table 5) shows the loadings of each of the items on each of the constructs. Table 6 shows the internal consistency reliabilities for each of the constructs in the initial model and the discriminant validity coefficients.

The measures of four constructs (support, self-efficacy, affect, and use) satisfied the criteria for reliability and discriminant validity in the initial model. The loadings were consistently high, cross loadings were low, and the variance shared between the constructs and their measures were greater than the variance shared between the constructs themselves. Thus, no changes to these constructs were indicated. The remaining constructs evidenced some measurement problems. These issues, and the associated revisions, are discussed below.

Encouragement by others. Three items in the encouragement of use construct did not correlate highly with the other measures. This was reflected in the individual item loadings. Encouragement of use from family, friends and subordinates did not appear to correlate highly with encouragement of use from the peers and managers. Thus, these 3 items were dropped from the model in subsequent tests.

Others' use. A similar problem was encountered in the measures of actual use by others. Actual use by family, friends and subordinates did not load highly on the construct. Moreover, actual use by subordinates loaded more highly on the encouragement by others construct than the others' use construct. Thus, these items

Table 5
Initial Model - Factor Structure Matrix

	1	2	3	4	5	6	7	8
1	**0.752**	0.501	0.235	0.135	0.181	0.191	-0.179	0.216
2	**0.663**	0.364	0.068	0.052	0.149	0.107	-0.120	0.071
3	**0.401**	0.172	0.136	0.016	0.041	0.130	-0.145	0.059
4	**0.512**	0.258	0.054	0.066	0.105	0.122	-0.145	0.074
5	**0.817**	0.477	0.175	0.108	0.303	0.217	-0.213	0.215
6	**0.822**	0.440	0.222	0.146	0.274	0.220	-0.201	0.175
7	**0.630**	0.225	0.202	0.071	0.121	0.160	-0.118	0.150
8	0.446	**0.827**	0.189	0.197	0.187	0.224	-0.186	0.325
9	0.376	**0.776**	0.032	0.182	0.201	0.218	-0.220	0.219
10	0.147	**0.157**	0.158	-0.054	-0.024	0.071	-0.037	0.023
11	0.218	**0.354**	0.025	0.059	0.080	0.109	-0.118	0.058
12	0.516	**0.746**	0.160	0.100	0.213	0.189	-0.159	0.186
13	0.396	**0.694**	0.225	0.066	0.178	0.145	-0.129	0.125
14	0.269	**0.201**	0.356	0.009	-0.072	0.057	-0.056	0.028
15	0.202	0.112	**0.839**	-0.086	-0.064	-0.095	0.035	-0.057
16	0.199	0.111	**0.890**	-0.078	-0.095	-0.056	0.033	-0.017
17	0.168	0.098	**0.877**	-0.036	-0.094	-0.027	0.003	0.010
18	0.185	0.041	**0.727**	-0.034	-0.029	-0.039	-0.010	-0.077
19	0.267	0.247	**0.770**	-0.095	-0.074	-0.121	0.021	-0.087
20	0.357	0.283	**0.702**	-0.001	0.037	0.051	-0.077	0.052
21	0.140	0.143	-0.098	**0.810**	0.276	0.456	-0.494	0.418
22	0.090	0.153-	0.084	**0.800**	0.228	0.410	-0.456	0.431
23	0.119	0.192	-0.086	**0.812**	0.281	0.458	-0.541	0.418
24	0.102	0.175	-0.112	**0.840**	0.206	0.416	-0.453	0.357
25	0.108	0.173-	0.057	**0.832**	0.253	0.410	-0.513	0.352
26	0.092	0.143	-0.047	**0.785**	0.205	0.349	-0.394	0.308
27	0.075	0.098	-0.127	**0.786**	0.275	0.392	-0.438	0.373
28	0.091	0.135	-0.011	**0.730**	0.255	0.332	-0.391	0.293
29	0.133	0.150-	0.009	**0.763**	0.295	0.406	-0.461	0.314
30	0.175	0.179	-0.073	**0.806**	0.346	0.470	-0.507	0.373
31	0.119	0.155	-0.114	0.186	**0.605**	0.314	-0.262	0.263
32	0.154	0.176	-0.060	0.172	**0.545**	0.254	-0.163	0.177
33	0.180	0.083	-0.006	0.078	**0.531**	0.255	-0.085	0.142
34	0.216	0.203	-0.084	0.182	**0.585**	0.221	-0.214	0.161
35	0.263	0.200	-0.052	0.257	**0.772**	0.455	-0.383	0.467
36	0.108	0.097	-0.089	0.104	**0.418**	0.152	-0.052	0.028
37	0.177	0.194	-0.128	0.205	**0.556**	0.215	-0.201	0.134
38	0.222	0.121	-0.010	0.157	**0.593**	0.301	-0.251	0.263
39	0.188	0.212	-0.092	0.321	**0.803**	0.421	-0.369	0.452
40	0.179	0.206	-0.047	0.252	**0.723**	0.341	-0.288	0.347
41	0.126	0.108	-0.010	0.204	**0.477**	0.200	-0.206	0.213

(continued on next page)

TABLE 5 (continued)
Initial Model - Factor Structure Matrix

	1	2	3	4	5	6	7	8
42	0.248	0.266	-0.110	0.492	0.467	**0.873**	-0.652	0.520
43	0.276	0.227	-0.041	0.368	0.443	**0.815**	-0.541	0.423
44	0.138	0.166	-0.070	0.308	0.329	**0.692**	-0.405	0.357
45	0.164	0.167	-0.050	0.438	0.279	**0.692**	-0.573	0.349
46	0.102	0.137	-0.088	0.359	0.332	**0.741**	-0.487	0.327
47	-0.083	0.010	-0.078	-0.194	-0.055	-0.123	**0.330**	-0.076
48	-0.230	-0.258	0.119	-0.338	-0.408	-0.669	**0.598**	-0.430
49	-0.108	-0.064	-0.035	-0.304	-0.084	-0.228	**0.428**	-0.092
50	-0.176	-0.154	0.059	-0.401	-0.352	-0.591	**0.606**	-0.332
51	-0.112	-0.047	0.069	-0.358	-0.222	-0.409	**0.604**	-0.257
52	0.026	0.004	0.029	-0.078	-0.138	-0.044	**0.140**	-0.082
53	-0.008	0.056	-0.012	-0.037	-0.117	-0.017	**0.127**	-0.023
54	-0.037	-0.007	0.092	-0.120	-0.073	-0.152	**0.246**	-0.059
55	-0.149	-0.090	-0.062	-0.100	-0.175	-0.122	**0.256**	-0.067
56	-0.225	-0.207	-0.037	-0.351	-0.261	-0.309	**0.550**	-0.292
57	-0.089	-0.126	-0.009	-0.140	-0.102	-0.184	**0.335**	-0.133
58	-0.159	-0.155	0.055	-0.486	-0.229	-0.518	**0.751**	-0.393
59	-0.114	-0.161	0.011	-0.327	-0.114	-0.277	**0.540**	-0.156
60	0.011	-0.099	-0.045	-0.243	-0.095	-0.245	**0.520**	-0.165
61	-0.129	-0.143	-0.007	-0.351	-0.224	-0.427	**0.653**	-0.307
62	-0.091	-0.135	-0.034	-0.284	-0.123	-0.295	**0.529**	-0.140
63	-0.173	-0.128	0.096	-0.198	-0.305	-0.330	**0.345**	-0.205
64	-0.081	-0.098	-0.033	-0.427	-0.247	-0.475	**0.704**	-0.352
65	-0.173	-0.116	-0.029	-0.048	-0.196	-0.179	**0.307**	-0.161
66	0.285	0.354	-0.059	0.429	0.391	0.463	-0.408	**0.806**
67	0.225	0.262	-0.002	0.349	0.397	0.432	-0.381	**0.794**
68	0.040	0.097	-0.051	0.267	0.227	0.286	-0.265	**0.645**
69	-0.005	0.009	-0.068	0.240	0.212	0.285	-0.266	**0.611**

Constructs:

1. Encouragement of Use
2. Others' Use
3. Support
4. Self-efficacy
5. Outcome Expectations
6. Affect
7. Anxiety
8. Use

were dropped from the subsequent analyses.

Table 6
Reliability and Discriminant Validity Coefficients - Initial Model

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.	7.	8.
1. Encouragement	0.85	**0.67**							
2. Others' Use	0.76	0.55	**0.60**						
3. Support	0.92	0.24	0.15	**0.80**					
4. Self-efficacy	0.95	0.14	0.19	-0.09	**0.80**				
5. Outcome Exp.	0.86	0.29	0.27	-0.10	0.33	**0.61**			
6. Affect	0.87	0.25	0.26	-0.09	0.52	0.49	**0.77**		
7. Anxiety	0.83	-0.24	-0.24	0.03	-0.59	-0.40	-0.71	**0.49**	
8. Use	0.81	0.22	0.29	-0.06	0.46	0.44	0.52	-0.47	**0.72**

† Internal Consistency Reliability

** Diagonal elements (shaded) are the square root of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

<u>Outcome expectations.</u> Examination of the loadings for the outcome expectations construct indicated the possibility of multiple underlying dimensions for this construct. Reconsideration of the items confirmed this hypothesis. Two distinct dimensions appeared to be represented in the scale, corresponding to the performance-related versus personal outcomes of computer use. Performance-related outcomes included items such as "If I use a computer, I will increase the quality of output of my job," while the personal outcomes included "If I use a computer, I will increase my sense of accomplishment." As a result, the outcome expectations was split into two constructs: Performance Outcome Expectations (consisting of items 5, 8, 9, 10, and 11) and Personal Outcome Expectations (consisting of items 2, 3, 4, 6, and 7). Item One did not load strongly on either factor, so it was dropped from the analysis.

Anxiety. The individual item loadings for this construct were poor, indicating a problem in the measurement of anxiety. Reexamination of the measure and exploratory factor analysis revealed a number of underlying dimensions. These dimensions reflected, in addition to anxiety, a desire to learn more about computers, beliefs about learning to use computers, and beliefs about the appropriateness of computers in business and education. Ultimately, four items were selected from the scale to reflect anxiety. These items were chosen because they seemed to best capture the feelings of anxiety associated with computer use.

The measurement model revisions were made as indicated and the model was tested using the holdback sample. The measurement statistics were substantially improved over the first model. Table 7 displays the factor structure matrix for the revised model, and Table 8 shows the internal consistency reliabilities and discriminant validity coefficients.

Overall, the revisions to the measures achieved the desired effects. One construct in the revised model is worthy of additional discussion, however. The factor structure matrix shows that for the Others' Use construct, the loadings of two items are high (0.89 and 0.85) while two are substantially lower (0.54 and 0.49). This pattern of loadings is an indication of multidimensionality in the construct. Examination of the items tends to support this interpretation. The first two items reflect the use of computers by the respondents' peers (both their peers in their organizations and their peers in other organizations). The last two items, on the other

Table 7. Factor Structure Matrix - Revised Model

	1	2	3	4	5	6	7	8	9
1	**0.825**	0.491	0.239	0.156	0.225	0.133	0.135	-0.089	0.114
2	**0.738**	0.340	0.054	0.142	0.221	0.147	0.188	-0.112	0.065
3	**0.827**	0.435	0.220	0.190	0.258	0.180	0.182	-0.087	0.219
4	**0.800**	0.397	0.273	0.143	0.144	0.153	0.119	-0.048	0.115
5	0.478	**0.890**	0.216	0.178	0.198	0.119	0.154	-0.070	0.233
6	0.371	**0.851**	0.046	0.152	0.208	0.087	0.133	-0.094	0.176
7	0.438	**0.544**	0.223	0.033	0.091	0.027	0.019	0.068	0.156
8	0.415	**0.492**	0.330	-0.022	0.025	0.013	-0.050	0.064	0.097
9	0.165	0.110	**0.810**	-0.046	-0.095	-0.100	-0.089	0.003	-0.075
10	0.170	0.095	**0.773**	-0.013	-0.039	-0.028	-0.051	-0.031	0.016
11	0.185	0.090	**0.761**	-0.004	-0.041	-0.064	-0.023	-0.038	0.044
12	0.189	0.125	**0.794**	-0.063	-0.066	-0.113	-0.102	0.007	-0.006
13	0.166	0.168	**0.765**	-0.147	-0.088	-0.108	-0.166	0.024	-0.105
14	0.271	0.206	**0.825**	-0.074	-0.073	-0.102	-0.084	-0.012	-0.007
15	0.128	0.083	-0.156	**0.829**	0.263	0.110	0.400	-0.402	0.338
16	0.133	0.092	-0.077	**0.804**	0.232	0.125	0.393	-0.378	0.323
17	0.163	0.199	-0.109	**0.839**	0.262	0.123	0.451	-0.497	0.411
18	0.178	0.154	-0.086	**0.858**	0.269	0.171	0.440	-0.405	0.380
19	0.145	0.127	-0.054	**0.852**	0.246	0.098	0.419	-0.452	0.375
20	0.222	0.166	-0.037	**0.818**	0.237	0.179	0.394	-0.344	0.325
21	0.145	0.135	-0.078	**0.828**	0.273	0.119	0.400	-0.399	0.408
22	0.124	0.150	-0.037	**0.714**	0.243	0.141	0.279	-0.323	0.331
23	0.174	0.160	-0.062	**0.760**	0.228	0.156	0.352	-0.356	0.286
24	0.207	0.154	-0.071	**0.796**	0.298	0.199	0.423	-0.436	0.411
25	0.168	0.055	-0.073	0.112	0.582	0.339	0.335	-0.108	0.227
26	0.233	0.172	-0.037	0.297	**0.842**	0.428	0.456	-0.252	0.406
27	0.242	0.168	-0.054	0.167	**0.700**	0.338	0.275	-0.137	0.224
28	0.210	0.246	-0.124	0.292	**0.859**	0.419	0.405	-0.168	0.340
29	0.204	0.207	-0.123	0.293	**0.787**	0.328	0.365	-0.168	0.311
30	0.112	0.078	0.042	0.140	**0.504**	0.234	0.201	-0.153	0.245
31	0.118	0.058	-0.089	0.108	0.339	**0.718**	0.232	-0.083	0.184
32	0.073	0.022	-0.064	0.067	0.409	**0.624**	0.273	-0.048	0.139
33	0.191	0.153	-0.035	0.170	0.413	**0.842**	0.286	-0.089	0.245
34	0.081	0.018	-0.177	0.123	0.296	**0.763**	0.184	0.045	0.104
35	0.228	0.128	-0.124	0.173	0.376	**0.817**	0.232	0.015	0.196
36	0.180	0.155	-0.121	0.461	0.455	0.280	**0.872**	-0.454	0.437
37	0.141	0.086	-0.124	0.375	0.431	0.342	**0.822**	-0.284	0.349
38	0.114	0.062	-0.151	0.218	0.292	0.251	**0.620**	-0.191	0.208
39	0.142	0.105	-0.060	0.441	0.290	0.113	**0.697**	-0.602	0.392
40	0.166	0.145	-0.045	0.303	0.326	0.227	**0.733**	-0.334	0.339
41	-0.104	-0.072	-0.003	-0.430	-0.235	-0.075	-0.486	**0.814**	-0.344
42	-0.056	-0.013	0.015	-0.304	-0.088	0.052	-0.264	**0.736**	-0.244
43	-0.085	-0.075	-0.001	-0.347	-0.159	-0.014	-0.364	**0.771**	-0.254
44	-0.091	-0.057	-0.004	-0.467	-0.225	-0.078	-0.463	**0.852**	-0.319
45	0.202	0.261	-0.065	0.381	0.374	0.236	0.415	-0.292	**0.798**
46	0.184	0.244	0.046	0.361	0.377	0.219	0.386	-0.334	**0.790**
47	0.018	0.049	-0.083	0.279	0.187	0.123	0.266	-0.227	**0.648**
48	0.013	0.074	-0.076	0.254	0.207	0.066	0.266	-0.202	**0.667**

Constructs:
1. Encouragement of Use
2. Others' Use
3. Support
4. Self-efficacy
5. Job Outcome Expectations
6. Personal Outcome Expectations
7. Affect
8. Anxiety
9. Use

Table 8.
Reliability and Discriminant Validity Coefficients - Revised Model

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.	7.	8.	9.
1 Encouragem't	0.87	**0.80**								
2. Others' Use	0.80	0.52	**0.72**							
3. Support	0.91	0.24	0.18	**0.79**						
4. Self-efficacy	0.95	0.20	0.18	-0.10	**0.81**					
5. Outcome Exp. - Performance	0.87	0.27	0.22	-0.09	0.32	**0.72**				
6. Outcome Exp. - Personal	0.87	0.19	0.11	-0.12	0.17	0 49	**0.76**			
6. Affect	0.87	0.20	0.15	-0.13	0.49	0.48	0.32	**0.75**		
7. Anxiety	0.87	-0.11	-0.07	-0.00	-0.50	-0.23	-0.05	-0.51	**0.79**	
8. Use	0.82	0.17	0.24	-0.05	0.45	0.41	0.24	0.47	-0.37	**0.73**

† Internal Consistency Reliability

** Diagonal elements (shaded) are the square root of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

hand, reflect the use of computers by the respondents' managers and subordinates. The distinction between these two dimensions of Others' Use is not strong, and the overall internal consistency is satisfactory (ICR = 0.80). Thus, while it is recognized that some multidimensionality exists for this construct, the measures were not changed.

Tests of Hypotheses

Once the measurement model was considered acceptable, the path coefficients were assessed (Figure 9, Table 9). Jack-knifing was used to assess the statistical significance of the paths in the model. All but one of the paths were statistically

Table 9
Summary of Hypothesis Testing

	Hypothesis	Support	Path
H1.	Encouragement → Self-efficacy	✓	0.18***
H2a.	Encouragement → Performance Outcome Expectations	✓	0.20***
H2b.	Encouragement → Personal Outcome Expectations	✓	0.20***
H3.	Others' Use → Self-efficacy	✓	0.11***
H4a.	Others' Use → Performance Outcome Expectations	✓	0.10***
H4b.	Others' Use → Personal Outcome Expectations	x	0.015
H5.	Support → Self-efficacy	x	-0.16***
H6a.	Support → Performance Outcome Expectations	x	-0.14***
H6b.	Support → Personal Outcome Expectations	x	-0.16***
H7a.	Self-efficacy → Performance Outcome Expectations	✓	0.24***
H7b.	Self-efficacy → Personal Outcome Expectations	✓	0.12***
H8.	Self-efficacy → Affect	✓	0.37***
H9.	Self-efficacy → Anxiety (negative)	✓	-0.50***
H10.	Self-efficacy → Use	✓	0.225***
H11a.	Performance Outcome Expectations → Affect	✓	0.32***
H11b.	Personal Outcome Expectations → Affect	✓	0.10***
H12a.	Performance Outcome Expectations → Use	✓	0.23***
H12b.	Personal Outcome Expectations → Use	✓	0.03***
H13.	Affect → Use	✓	0.19***
H14.	Anxiety → Use (negative)	✓	-0.11***

*** $p < 0.001$

significant. However, three of the paths were in the opposite direction from that predicted by the model. Contrary to hypotheses 5 and 6a and b, support was negatively related to both computer self-efficacy and outcome expectations. Possible reasons for this surprising finding will be raised in the Discussion section of this chapter.

For proper interpretation of the results, it is not sufficient to examine the statistical significance of the paths. The substantive significance of the relationships must also be considered. The path coefficients in the PLS model represent

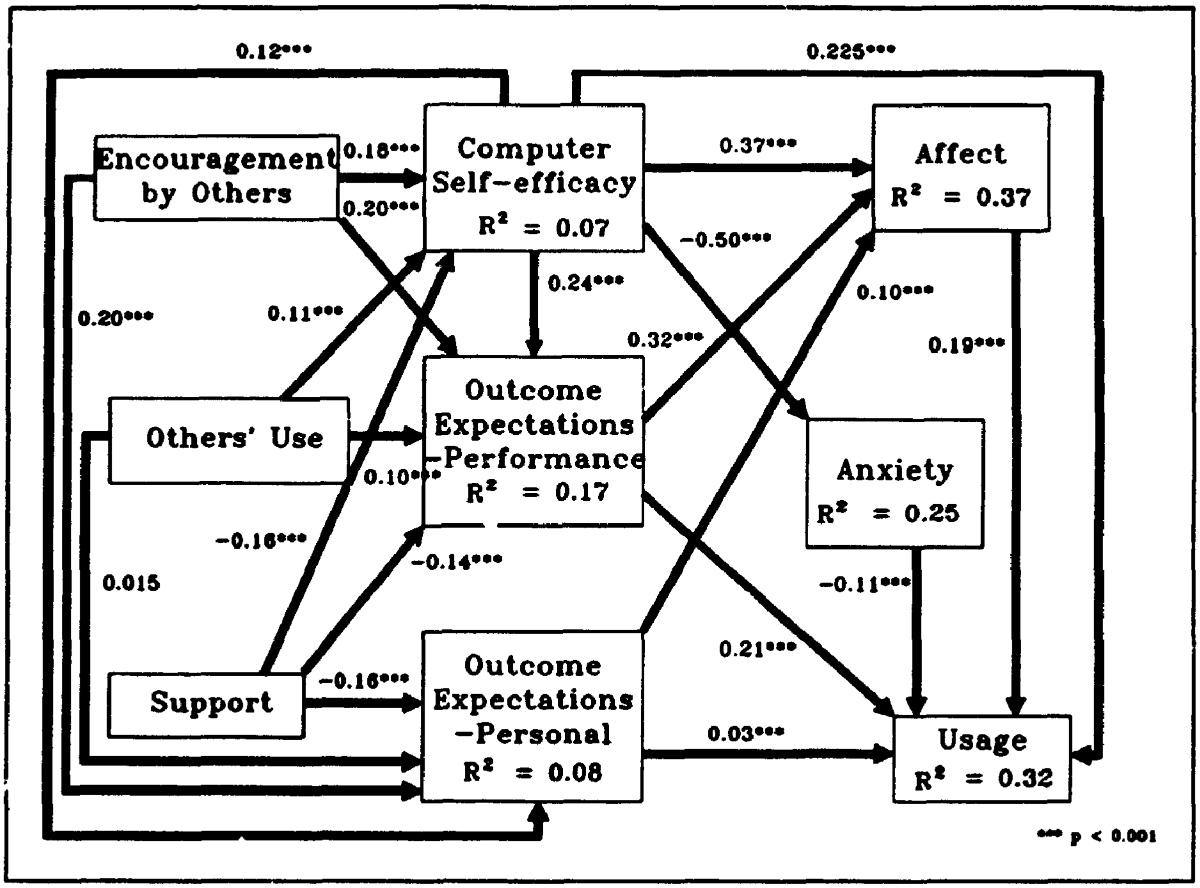


Figure 9. Revised Model

standardized regression coefficients. Pedhazur (1982) suggests 0.05 as the lower limit of substantive significance for regression coefficients. As a more conservative position, path coefficients of 0.10 and above are preferable. Only one of the significant paths did not meet this criterion. The path coefficient linking personal outcome expectations and use, while significant, was only 0.03.

The path coefficients represent the direct effects of each of the antecedent constructs. It is also important, however, to consider the total effects, which include both the direct and indirect effects (Table 10). In particular, performance-related

Table 10
Total Effects

	Dependent Constructs					
Independent Constructs	4.	5.	6.	7.	8.	9.†
1. Encouragement	0.18	0.25	0.22	0.17	-0.09	0.14
2. Others' Use	0.11	0.13	0.03	0.08	-0.05	0.07
3. Support	-0.16	-0.18	-0.18	-0.13	-0.08	-0.11
4. Self-efficacy	.	0.24	0.12	0.46	-0.50	0.42
5. Performance Outcome Expectations	.	.	.	0.32	.	0.27
6. Personal Outcome Expectations	.	.	.	0.10	.	0.05
7. Affect	.	.	.	.	.	0.19
8. Anxiety	.	.	.	.	.	0.11

† 9. = Use

outcome expectations and self-efficacy have roughly equal direct effects on use. However, when the total effects are considered, self-efficacy emerges as a more powerful predictor (total effect = 0.423 versus 0.269 for outcome expectations).

In total, the model explained 37% of the variance in affect, 25% of the variance in anxiety, and 32% of the variance in use. In addition, seven percent of the variance in computer self-efficacy, 17% of the variance in performance-related outcome expectations, and 8% of the variance in other outcome expectations was explained. Thus, in terms of explanatory power, the model is acceptable.

IV. Follow Up Survey

The purpose of the follow up survey was to provide stronger causal evidence of the impact of self-efficacy and outcome expectations on individual reactions to computing technology. J. S. Mill (in Cook and Campbell, 1979) argued that three criteria must be satisfied before causation can be inferred. First, there must be covariation between the presumed cause and effect. Clearly, in order to conclude that one thing causes another, the two must be related somehow. Second, the presumed cause must be temporally precedent to the presumed effect. That is, the cause must be observed before the effect in time. Finally, alternative interpretations, or rival explanations must be ruled out.

Given that Social Cognitive Theory predicts a reciprocal relationship between the variables (e.g., efficacy is seen as both an influence on usage and a result of usage), the cross-sectional survey design was limited in terms of establishing the causal structure of the model. While the model tested was certainly plausible, it satisfied only the first of Mills' criteria.

In order to establish the causal argument more strongly, longitudinal data were required. In order to satisfy Mills' second criterion (temporal precedence) it was necessary to establish whether self-efficacy and outcome expectations at one point in time would be predictive of usage at a later point in time. Thus, one year following the initial data collection, a follow up survey was sent to all of the respondents to the initial survey.

Satisfying Mills' third and final criterion requires ruling out alternative explanations of the relationship, or controlling for other factors which might influence the relationship. This is an ongoing process, in which competing theories are tested and compared. The present research cannot compare all the competing theories. Rather it seeks to present a plausible argument as to the causal structuring of the variables based on Social Cognitive Theory.

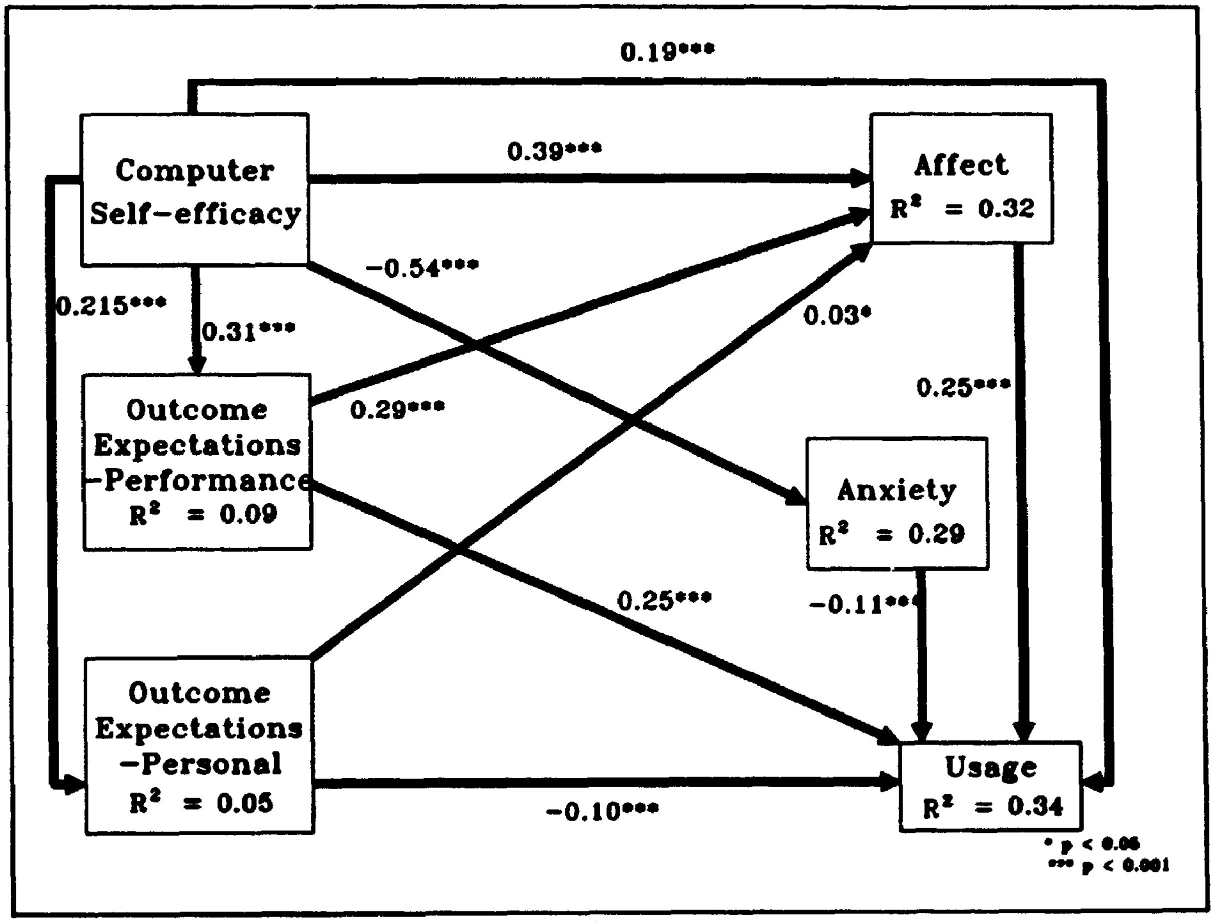


Figure 10. Research Model - Longitudinal Follow Up

Hypotheses

The research model which guided the follow up survey is shown in Figure 10. This model focuses on the latter half of the model tested in the main study, and relates self-efficacy and outcome expectations at time 1 to affect, anxiety and use at time 2. The two dimensions of outcome expectations (performance-related versus personal) uncovered in the original model were maintained in this research model. This model, thus provides an additional test of hypotheses 7 through 14, already described for the main study. Of particular importance are the hypotheses which relate variables across time (H8 to H12).

Research Design

Measures

The measures used in the follow up survey were identical to those used in the main study. This was necessary in order to ensure that the same constructs were being measured at the two different points in time. Self-efficacy, outcome expectations, affect, anxiety and usage were all included in the follow up questionnaire. The follow up questionnaire is shown in Appendix E.

Sample

The follow up survey was sent to all of the people (1022) who had responded to the first survey. One hundred and twenty-eight (128) were returned as undeliverable. Of the remaining 894, a total of 598 were completed and returned, for a net response rate of 67%. To test for the possibility of non-response bias, a multivariate analysis of variance was conducted to compare early versus late respondents on the constructs of interest. The test was not significant (Wilks' $\Lambda =$ 0.98, $p > 0.95$), and thus non-response bias was not considered to be a serious problem.

Procedures

In terms of collecting the data, the procedures used were consistent with the procedures used in other phases of the research. The questionnaire was mailed to the potential respondents along with a postage paid envelope. The accompanying cover letter is shown in Appendix F. A follow up letter (Appendix G) was sent after 3 weeks to encourage people to respond.

Matching. Respondents were identified in both phases of the research by a unique number. Thus, it was possible to match individual responses on the first questionnaire to those on the second. In order to ensure that the questionnaires had been completed by the same person, further matching was also conducted. Comparisons of demographic variables, including age, gender and educational background were made across the two questionnaires. If there was any discrepancy between the values reported on the two questionnaires, the responses were eliminated. The final sample, thus consisted of 394 matched responses to both the original and follow up questionnaires.

Results

Table 11 shows the means and standard deviations for the various familiarity and usage variables measured. Paired t-tests were conducted to test whether familiarity and usage had changed significantly in the intervening year (Table 12). Overall, familiarity had not changed significantly, but differences were found for familiarity with some specific applications, such as mainframe hardware, database,

Table 11
Means and Standard Deviations
Familiarity and Usage Items
(Follow Up Survey)

Item	Mean	Std. Dev.
T2FAM1 - Overall Experience	3.66	1.02
T2FAM2 - Apple PCs	1.99	1.24
T2FAM3 - IBM PCs	3.83	1.10
T2FAM4 - Minicomputers	2.05	1.17
T2FAM5 - Mainframes	2.12	1.25
T2FAM6 - Spreadsheets	3.65	1.26
T2FAM7 - Word Processing	3.72	1.13
T2FAM8 - Database Packages	2.52	1.20
T2FAM9 - Statistics	2.01	1.09
T2FAM10 - Graphics	2.71	1.27
T2FAM11 - Electronic Mail	3.03	1.49
T2FAM12 - Programming Languages	1.82	1.16
T2CHUSE - Change from Last Year	3.37	0.78
T2FREQ_W - Frequency of Use at Work	5.18	1.46
T2USE1 - Hours Used at Work	2.04	1.69
T2FREQ_H Frequency of Use at Home	3.41	1.91
T2USE5 - Hours Used at Home (weekdays)	0.81	1.12
T2USE6 - Hours Used at Home (weekends)	1.43	1.65

n=394

programming languages (all of which had decreased) and electronic mail (which had increased). Usage, by contrast, increased markedly between the original and follow up surveys. Frequency and duration of use at work were significantly higher, as was the degree to which respondents possessed and used home computers.

The next logical question was whether the research model could be used to explain the changes in usage. In other words, were these observed changes related to self-efficacy and outcome expectations as measured in the original questionnaire?

Table 12
Differences in Familiarity and Use from Main Study to Follow Up Questionnaire

Item	t†	p
T2FAM1-FAM1 - Overall Familiarity	1.10	0.27
T2FAM2-FAM2 - Apple PCs	-0.88	0.38
T2FAM3-FAM3 - IBM PCs	1.44	0.15
T2FAM4-FAM4 - Minicomputers	-0.70	0.48
T2FAM5-FAM5 - Mainframes	-2.99	0.00
T2FAM6-FAM6 - Spreadsheets	0.00	1.00
T2FAM7-FAM7 - Word Processing	-0.11	0.91
T2FAM8-FAM8 - Database Packages	-2.16	0.03
T2FAM9-FAM9 - Statistics	0.84	0.40
T2FAM10-FAM10 - Graphics	0.40	0.68
T2FAM11-FAM11 - Electronic Mail	2.22	0.03
T2FAM12-FAM12 - Programming Languages	-3.21	0.00
T2FREQ_W-USE3 - Frequency of Use at Work	3.03	0.00
T2USE1-USE1 - Hours of Use at Work	6.80	0.00
T2USE5-USE5 - Hours of Use at Home (weekdays)	11.54	0.00
T2USE6-USE6 - Hours of Use at Home (weekends)	11.55	0.00

† A positive t-value indicates an increase in the variable, a negative value indicates a decrease.

n=394

This question was tested using PLS. The research model was tested using data from time 1 to measure self-efficacy and outcome expectations and data from time 2 to measure affect, anxiety, and use. The results of this analysis are shown in Table 13 to Table 16.

The validity of the measures was assessed by examining the loadings and cross-loadings of individual variables on the constructs (Table 13). In addition, internal consistency reliabilities and discriminant validity coefficients were calculated

Table 13
Factor Structure Matrix

		Outcome Expectations				
	Efficacy	Perform.	Personal	Affect	Anxiety	Use
CSE1	0.806	0.270	0.162	0.442	-0.461	0.352
CSE2	0.789	0.254	0.182	0.447	-0.413	0.364
CSE3	0.820	0.267	0.151	0.486	-0.508	0.454
CSE4	0.811	0.182	0.160	0.401	-0.414	0.324
CSE5	0.819	0.267	0.115	0.491	-0.500	0.381
CSE6	0.797	0.217	0.169	0.407	-0.421	0.301
CSE7	0.795	0.245	0.204	0.455	-0.472	0.312
CSE8	0.713	0.191	0.180	0.308	-0.372	0.246
CSE9	0.743	0.229	0.160	0.408	-0.417	0.268
CSE10	0.808	0.286	0.216	0.457	-0.485	0.342
OUT1	0.094	0.558	0.322	0.278	-0.131	0.206
OUT5	0.288	0.828	0.460	0.456	-0.310	0.363
OUT8	0.175	0.658	0.292	0.246	-0.185	0.246
OUT9	0.280	0.837	0.469	0.397	-0.256	0.346
OUT10	0.221	0.726	0.365	0.305	-0.174	0.274
OUT11	0.174	0.530	0.254	0.232	-0.116	0.181
OUT2	0.153	0.396	0.713	0.222	-0.064	0.163
OUT3	0.121	0.386	0.629	0.261	-0.028	0.027
OUT4	0.181	0.435	0.822	0.272	-0.103	0.142
OUT6	0.105	0.326	0.707	0.138	0.051	0.012
OUT7	0.202	0.391	0.813	0.246	-0.082	0.113
AFFECT1 (TIME2)	0.477	0.430	0.283	0.843	-0.471	0.422
AFFECT2 (TIME2)	0.393	0.396	0.299	0.801	-0.327	0.337
AFFECT3 (TIME2)	0.249	0.261	0.221	0.599	-0.170	0.235
AFFECT4 (TIME2)	0.501	0.285	0.135	0.678	-0.605	0.306
AFFECT5 (TIME2)	0.320	0.309	0.212	0.675	-0.305	0.329
ANX12 (TIME2)	-0.533	-0.257	-0.103	-0.504	0.835	-0.358
ANX14 (TIME2)	-0.331	-0.155	0.019	-0.277	0.663	-0.219
ANX15 (TIME2)	-0.393	-0.208	-0.027	-0.352	0.783	-0.297
ANX18 (TIME2)	-0.484	-0.282	-0.099	-0.504	0.835	-0.312
WORK HRS. USE (TIME2)	0.362	0.330	0.175	0.374	-0.313	0.761
FREQ. USE (TIME 2)	0.298	0.308	0.125	0.350	-0.268	0.706
HOME HRS WKDAY (T2)	0.285	0.264	0.053	0.298	-0.239	0.731
HOME HRS WKEND (T2)	0.283	0.237	0.028	0.289	-0.288	0.684

Table 14
Reliability and Discriminant Validity Co-efficients
Follow Up Model

	ICR†	1.	2.	3.	4.	5.	6.
1. Self-efficacy	0.94	0.79					
2. Performance Outcome Exp.	0.85	0.31	0.70				
3. Personal Outcome Exp.	0.86	0.21	0.53	0.74			
4. Affect	0.86	0.48	0.43	0.27	0.72		
5. Anxiety	0.91	-0.54	-0.30	-0.11	-0.64	0.78	
6. Use	0.81	0.43	0.40	0.15	0.50	-0.44	0.72

† Internal Consistency Reliability

** Diagonal elements (shaded) are the square root of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

(Table 14), following the same procedures used in the initial survey. All of the measures proved to be reliable, and demonstrated adequate discriminant validity. While some of the items used to measure outcome expectations were weak (notably OUT1 and OUT11), overall the constructs were acceptable.

Table 15
Summary of Hypothesis Testing

	Hypothesis	Support	Path
H7a.	Self-efficacy → Performance Outcome Expectations	✓	0.306***
H7b.	Self-efficacy → Personal Outcome Expectations	✓	0.215***
H8.	Self-efficacy → T2 Affect	✓	0.387***
H9.	Self-efficacy → T2 Anxiety (negative)	✓	-0.536***
H10.	Self-efficacy → T2 Use	✓	0.193***
H11a.	Performance Outcome Expectations → T2 Affect	✓	0.293***
H11b.	Personal Outcome Expectations → T2 Affect	✓	0.032*
H12a.	Performance Outcome Expectations → T2 Use	✓	0.254***
H12b.	Personal Outcome Expectations → T2 Use	x	-0.104***
H13.	T2 Affect → T2 Use	✓	0.253***
H14.	T2 Anxiety → T2 Use (negative)	✓	-0.109***

* $p < 0.05$ *** $p < 0.001$

Hypothesis Testing

The relationships in the structural model were consistent with the findings from the original survey (Table 15). Both self-efficacy and performance-related outcome expectations had a significant impact on individual reactions, with path coefficients similar in magnitude to the initial study. Thus, the original findings regarding the influence of self-efficacy and performance-related outcome expectations were supported and strengthened, due to the presence of a time separation between responses. The results for personal outcome expectations were weaker. Personal Outcome Expectations had very little influence on Affect ($\beta=0.032$ compared with $\beta=0.10$ from the initial survey). Moreover, the relationship to usage was found to be negative (β=-0.104) rather than positive as was the case in the initial model (β=0.03).

Table 16
Variance Explained in Dependent Constructs

Construct	R^2
Performance Outcome Expectations	0.094
Personal Outcome Expectations	0.046
Affect	0.322
Anxiety	0.287
Use	0.343

In terms of explained variance, the model again performed adequately (Table 16). A slightly higher proportion of variance was explained in anxiety (R^2=29% compared to R^2=25%) and in use (R^2=34% compared to R^2=32%), while a slightly lower proportion of variance was explained in affect (R^2=32% compared to R^2=37%).

V. Discussion

The results of this phase of the study provide evidence of the validity of the computer self-efficacy measure and support for the Social Cognitive Theory perspective on individual reactions to computing technology.

In terms of validity, two aspects of the measure were considered: internal consistency, and discriminant validity. Nunnally (1978) points to these factors as key elements in the assessment of construct validity. Internal consistency, or reliability, indicates that the construct is measured without random error, and is a necessary but not sufficient condition for construct validity. The computer self-efficacy scale demonstrated consistently high reliability (Cronbach's $\alpha = 0.94$) in all phases of the study.

Discriminant validity indicates the degree to which the construct measured is distinct from other constructs. Here again, the computer self-efficacy measure demonstrated adequate measurement properties. All of the items designed to measure computer self-efficacy loaded highly on the self-efficacy construct and low on all of the other constructs, in both the original and follow up surveys. The summary measures of discriminant validity, which compared the variance shared between the construct and its measure and between constructs, also indicated that computer self-efficacy was a distinct concept.

Another factor which plays a role in the assessment of validity, but was not considered here, is convergent validity. This aspect of validity concerns the degree to which different methods of measuring the same construct (such as observation and survey responses) yield similar results. Different methods for measuring computer self-efficacy were not available in the present study, and thus convergent validity was not assessed.

From a theoretical perspective, these results provide substantial support for the behaviour choice model. Computer self-efficacy and outcome expectations were shown to be significant predictors of affect, anxiety and actual use. The hypotheses regarding the influence of outcome expectations, affect and anxiety confirmed existing views of individual reactions to computing technology. If the use of computers is seen as providing benefits (or positive outcomes) to the user, individuals are more likely to use them. Moreover, because the use of computers is associated with these positive outcomes, individuals will derive more enjoyment from their use. Emotional responses, such as affect and anxiety, will also influence individuals' use of computers. With respect to the influence of computer self-efficacy, this research demonstrates that it too plays an important role in shaping individuals' feelings and behaviours. Individuals with high computer self-efficacy use computers more, derive more enjoyment from their use of computers, and experience less computer anxiety.

These findings were strengthened through the use of longitudinal data. Social Cognitive Theory predicts causal relationships between the constructs studied. PLS analysis provides strong support for this interpretation relative to other techniques such as correlation and regression, since all of the relationships (including those in the measurement model as well as in the structural model) are tested simultaneously. However, conclusive statements about causality cannot be made, since alternative explanations cannot be ruled out. The follow up survey, by separating the measurement of predicted causes and effects, demonstrates stronger evidence of a causal relationship between the cognitive factors (self-efficacy and outcome expectations) and individual reactions (affect, anxiety and use).

A surprising, and somewhat puzzling, finding of this research was the negative influence of support on self-efficacy and outcome expectations. From a theoretical perspective, it seemed logical to hypothesize that higher organizational support would result in higher judgments of self-efficacy on the part of individuals, because they would have more resources to help them become more proficient. Moreover, support was believed to be an indication of organizational norms regarding use, and would thus positively influence outcome expectations in addition to self-efficacy. However, the data analysis suggested a negative relationship.

The reasons for these findings are not entirely clear, however, several possibilities exist. With respect to self-efficacy in particular, it may be that individuals with lower self-efficacy are more aware of the existence of support within their organizations than those with high self-efficacy, because they make more use of those systems. Alternatively, the presence of high support may, in some ways, actually hinder the formation of high self-efficacy judgments. If an individual can always call someone to help them when they encounter difficulties, they may never be forced to sort things out for themselves, and thus may continue to believe themselves incapable of doing so. These alternative explanations have very different implications for organizations, and the data provide no indication as to which might be correct. Clearly, additional research is needed to investigate this finding.

A second unexpected finding relates to the differential findings for performance and personal outcome expectations. In the initial survey, both performance and personal outcome expectations significantly influenced affect and usage. However, performance outcome expectations had a consistently stronger effect on both affect ($\beta=0.32$ for performance outcome expectations, $\beta=0.10$ for personal outcome expectations) and use ($\beta=0.23$ for performance outcome expectations, $\beta=0.03$ for personal outcome expectations). In the follow up survey, similar results were found for the influence of outcome expectations on affect ($\beta=0.29$ for performance outcome expectations, $\beta=0.03$ for personal outcome expectations). Moreover, while a positive relationship was observed between performance outcome expectations and use ($\beta=0.25$), a negative relationship was observed between personal outcome expectations and use ($\beta= -0.10$).

The relative strength of performance outcome expectations as a predictor of affect and usage seems to suggest that, at least within the work environment, outcomes which relate specifically to the job are most salient in influencing individual reactions. Thus, for example, in deciding whether to use computers at work, people are more likely to be influenced by expectations of whether computers will help them in their jobs, than expectations of whether using computers will increase their social status.

The reason for the negative influence of personal outcome expectations in the follow up research model is less clear. From a theoretical as well as intuitive perspective, any expectation of positive benefits should result in increased, not decreased, usage. Thus, the presence of a negative relationship tends to suggest a missing construct in the model or some other model mis-specification. For example, it may be that the individual's self-efficacy partly moderates the relationship from personal outcome expectations to use. That is, individuals with high personal outcome expectations will only use computers if they also have high self-efficacy. This interpretation is consistent with Social Cognitive Theory. Alternatively, there may be other constructs missing from the model (such as degree of choice over whether computers are used at work) which would help to explain the relationship. Clearly, this is one area where additional research is necessary.

VI. Conclusion

This chapter has described the first phase of the research investigating individual reactions to computing technology from a Social Cognitive Theory perspective. The evidence provided substantial support for this theory as a means of understanding emotional reactions (affect and anxiety) and choice behaviours (use).

Chapter Four reports on the second phase of the research, which extended the analysis to look at performance issues, specifically the acquisition of computer skills. Chapter Five will discuss the limitations of the research and the implications of the findings for academics and practitioners.

CHAPTER FOUR - STUDY 2: THE EXPERIMENT

I. Overview

The national survey focused on the application of Social Cognitive Theory to choice behaviour. The results suggest, as predicted, that the decision to use computers is influenced by self-efficacy and outcome expectations. In addition, emotional responses, such as affect and anxiety are also influenced by self-efficacy and outcome expectations.

Understanding why people choose to use computers is clearly an important research goal, but it is also important to understand what factors influence the level of skill demonstrated by individuals in their use of computers. Study Two, described in this chapter, focuses primarily on understanding the antecedents of computing skills and how skills are developed.

The specific context chosen for this research was the area of computer training. The training setting was chosen for a number of reasons. First, training plays a central role in the Social Cognitive Theory perspective on behaviour since training represents a powerful way of influencing both self-efficacy and outcome expectations.

Second, training is a significant problem within the IS research community. Both academics (Fuerst & Cheney, 1982; Igbaria et al., 1989; Leonard-Barton & Deschamps, 1988; Lucas, 1974; Raymond, 1988; Sanders & Courtney, 1985) and practitioners (Guidice, 1990; Lewis, 1990; Monsalve & Triplett, 1990; Oberle, 1990;

Pennefather, 1989; Redkey, 1990; Shulman, 1990; Tannenbaum, 1990; Warner & Smith, 1990) attest to the importance of training. However, it is not sufficient to understand that training is important. Rather, we must understand the mechanisms through which training operates and the relative impact of different training methods. Research addressing these issues is much more limited, and is inconclusive (Bostrom et al., 1990; Davis & Bostrom, 1990; Olfman & Bostrom, 1990; Sein & Bostrom, 1989; Webster et al., 1990).

Finally, the training setting is amenable to experimentation. That is, a training program offers an opportunity to introduce an intervention designed to alter self-efficacy perceptions and to monitor those changes closely over a short period of time.

For the above reasons this study examined the influence of training, specifically training which employs the technique of behaviour modeling, on the development of computer skills from the perspective of Social Cognitive Theory.

II. Research Model and Hypotheses

Social Cognitive Theory provided a promising theoretical foundation from which to approach the study. As discussed in Chapter Two, self-efficacy has been shown to influence performance, as well as choice behaviour (Gist et al., 1989). Moreover, behaviour modeling has been shown to be an effective means of altering self-efficacy perceptions. As a training method, modeling also provides examples of appropriate performance, and information about outcomes.

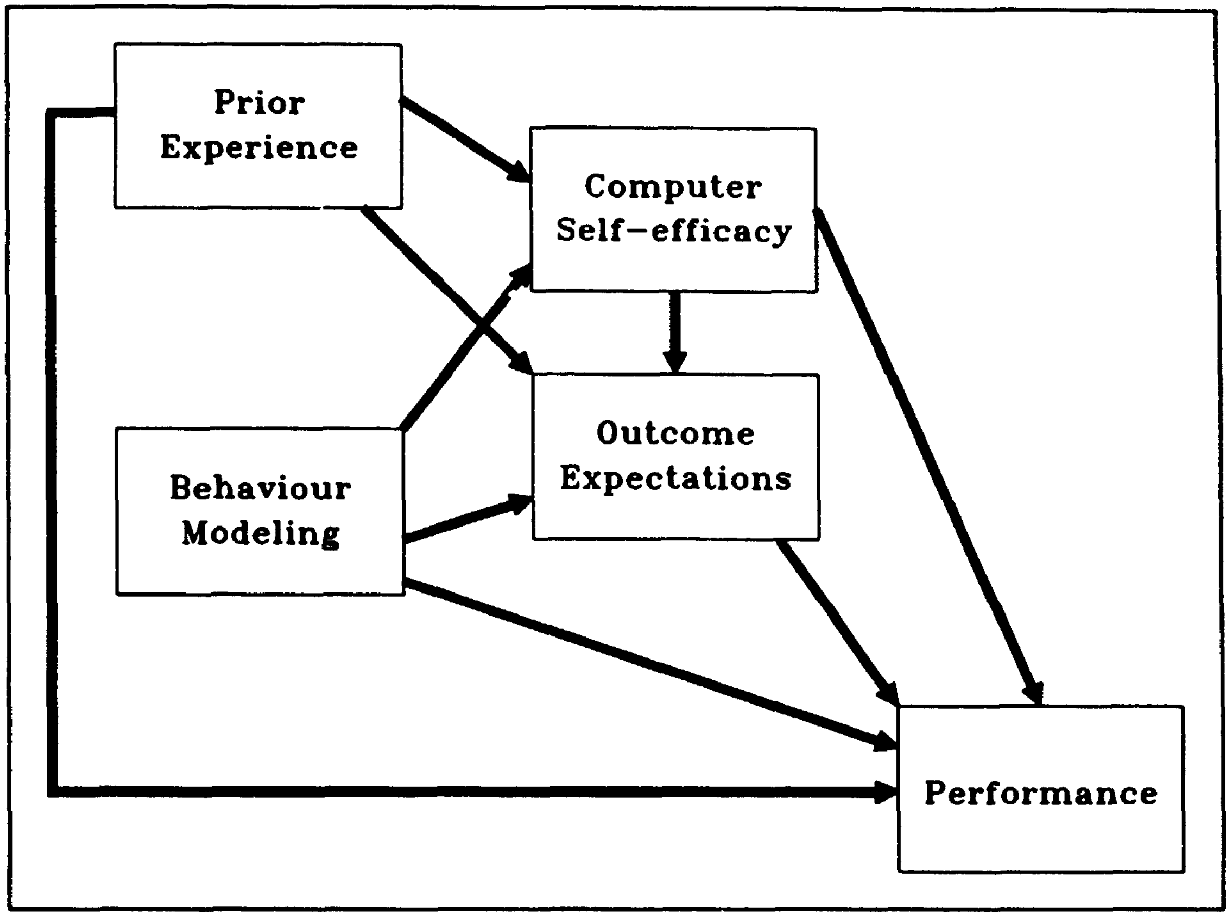


Figure 11. Research Model

Figure 11 presents the research model which guided the study. Prior experience with the behaviour and behaviour modeling are each held to directly impact self-efficacy, outcome expectations, and performance. Self-efficacy is posited to influence outcome expectations and performance, and outcome expectations also influence performance.

The following sections describe each element of the model in detail, and present the hypotheses relating them. The reader is also referred to the discussion of behaviour modeling and self-efficacy presented in Chapter Two for additional details.

Behaviour Modeling

According to Social Cognitive Theory, one of the principal mechanisms through which behaviour modeling operates is self-efficacy (Bandura, 1986). Observing someone else performing the target behaviour raises the subjects' perceptions of their own ability to perform it successfully. This effect has been shown in several studies, across a diverse range of behavioural domains (Bandura et al., 1977; Bandura, 1982; Brown & Inouye, 1978; Schunk, 1981). Only one study has examined the impact of behaviour modeling on the development of computer self-efficacy. Gist et al. (1989) compared computer-assisted instruction (CAI) to behaviour modeling in a spreadsheet training workshop. Subjects in the behaviour modeling condition were found to develop higher self-efficacy than those in the CAI condition. The first hypothesis of Study Two was as follows:

> **H1. Subjects who receive behaviour modeling training will develop higher perceptions of computer self-efficacy than subjects who receive non-modeling training.**

Modeling also influences outcome expectations. Bandura (1971) demonstrated that modeled behaviour that is rewarded is adopted by the observers. He argued that this behaviour was the result of a vicariously learned outcome expectation. Subjects learned from the experience of the models that the behaviour would be rewarded, and thus adopted the behaviour in order to achieve similar outcomes. This effect has not been studied in an information systems context. It sees reasonable to assert, however, that models who experience a sense of personal accomplishment, or express their beliefs that their new computer skills will enhance their effectiveness or productivity, convey information which may alter the subjects' outcome expectations. Thus, hypothesis two was as follows:

> **H2. Subjects who receive behaviour modeling training will develop higher outcome expectations than subjects who receive non-modeling training.**

In addition to its influence on self-efficacy and outcome expectations, modeling can directly influence performance, by demonstrating appropriate strategies for performance (Bandura, 1986; Schunk, 1981). Within the context of computer training, the models might be observed using screen prompts and the help facility to solve problems. Subjects then have the opportunity to learn effective tactics for dealing with similar situations in their own efforts.

> **H3. Subjects who receive behaviour modeling training will score higher than those in non-modeling training on measures of performance.**

Self-Efficacy

Social Cognitive Theory (Bandura, 1986) predicts that self-efficacy expectations will influence the subjects' actual ability to perform the behaviour. Frayne (1986) demonstrated the effect of self-efficacy on performance in the context of a study on absenteeism. Schunk (1981) showed that performance in mathematics was influenced by perceptions of self-efficacy. Accordingly, hypothesis four was as follows:

> **H4. Individuals with high computer self-efficacy will score higher than those with low computer self-efficacy on measures of performance.**

Social Cognitive Theory also suggests that self-efficacy influences outcome expectations (Bandura, 1978). This hypothesis was discussed in Chapter Three (hypothesis 7), and was supported by the data analysis from the survey. Thus, the next hypothesis was as follows:

H5. Individuals with high computer self-efficacy will demonstrate higher outcome expectations regarding computer use than individuals with low self-efficacy.

Outcome Expectations

Social Cognitive Theory holds that expectations about the consequences of behaviour are a strong force guiding individuals' actions. Individuals are more likely to undertake behaviours they believe will result in valued outcomes than those which they do not see as having favourable consequences. The influence of outcome expectations on computing behaviour has been demonstrated by Hill et al. (1987), Moore (1989), Pavri (1988), and Thompson et al. (1991), and was confirmed in the survey (Chapter 3, hypothesis 12). These studies dealt with choice behaviour, however, and thus do not address the relationship between outcome expectations and performance. Social Cognitive Theory also suggests that outcome expectations influence performance as well as choice (Bandura, 1986). Individuals who expect positive benefits from using computers would be expected to be more highly motivated than those who do not expect positive benefits, and to persist more in their attempts to learn. Thus, the next hypothesis was:

H6. Individuals who expect positive outcomes from their use of computers will exhibit higher performance than those who do not expect positive outcomes.

Prior Performance

Three additional hypotheses were formulated to reflect the influence of prior performance on self-efficacy, outcome expectations and performance. First, prior performance or prior experience with the behaviour has been shown to play a substantial role in the formation of self-efficacy judgments. Wood and Bandura (1989) demonstrated this effect in studies of a series of simulated organizations. Bandura and Schunk (1981) found that successful performance in mathematics builds self-efficacy. Similarly, Locke et al. (1984) found that performance in a brainstorming task predicted future self-efficacy with respect to the task. Thus, hypothesis 7 was formulated as follows:

> **H7. Subjects who have more positive prior experience with using computers will develop higher perceptions of computer self-efficacy than subjects who have negative prior experience with using computers.**

Prior experience using computers can also contribute to the formation of outcome expectations. Bandura (1986) noted that "response outcomes influence behavior antecedently by creating expectations of similar outcomes on future occasions" (p. 229). Thus, in terms of computing behaviour, individuals whose past use of computers has been successful and rewarding are more likely to expect positive outcomes in the future. Hypothesis 8 formally describes this relationship.

> **H8. Subjects who have more positive prior experience with using computers will develop higher outcome expectations than subjects who have negative prior experience with using computers.**

Finally, prior experience can be expected to directly influence performance. Individuals who perform well on one type of computing task perform well partly because they possess particular skill in the task domain. These individuals are likely, other things being equal, to perform well in related tasks. This approach was taken by Wood and Bandura (1989) in assessing performance in a simulated organization. Prior performance was found to be a significant predictor of current performance. The last hypothesis of the study, then, is as follows:

> **H9. Subjects who have more positive prior experience with using computers will exhibit higher performance than subjects who have negative prior experience with using computers.**

III. Research Design

Overview

The study was conducted over the course of a two day training workshop. Eighty-eight research subjects completed a two day training course covering Lotus 1-

Table 17
Experimental Groups

SESSION	TRAINING METHOD	GROUP							
		1	2	3	4	5	6	7	8
ONE	Modeling	WP	SS	WP	SS				
	Non-modeling					WP	SS	WP	SS
TWO	Modeling	SS	WP			SS	WP		
	Non-modeling			SS	WP			SS	WP

2-3 and WordPerfect. They were randomly assigned to one of eight experimental groups for the training (Table 17). The eight groups differed in terms of the order in which the software packages were taught and in terms of the use of different instructional techniques. Two groups received modeling training for both packages, two received exclusively non-modeling training, and the remainder received a combination of modeling training for one package and non-modeling training for the other.

All subjects received substantial training in the use of the software package. This is in direct contrast to previous studies of modeling, in which the control group was entirely untreated. The decision to adopt this approach was also based on the need for a stricter test of behaviour modeling. Prior studies of modeling, relying on comparison with an untreated control group, can, at best, conclude that modeling training is an effective way to promote behaviour change. They cannot, however, speak to its relative effectiveness compared with other instructional techniques.

The modeling intervention was implemented through a 20 minute videotape. The videotaped model performed introductory exercises on the computer, expressing frustration initially, but eventually achieving some success. This approach to modeling was based on studies by Meichenbaum (1971) and Dillon, Graham and Aidells (1972), who suggested that models who demonstrate too facile a performance are not as effective as those who demonstrate some difficulty.

Self-efficacy and outcome expectations were measured after the videotape (or after the training for the control group). Performance was measured at the end of each day of training, through both a paper and pencil comprehension test and a hands-on performance test. Figure 12 shows the sequencing of activities for the participants in the study.

Pilot Study: Development of the Modeling Tapes

In order to develop realistic, effective tapes for the behaviour modeling intervention, a pilot study was conducted. In this study, thirteen subjects were videotaped as they used WordPerfect or Lotus 1-2-3 for the first time.

Subjects

Thirteen subjects were recruited for the pilot study through an advertisement in the local daily newspaper (Appendix H). The subjects were promised a free introductory lesson on one of WordPerfect or Lotus in exchange for allowing us to videotape their practice session. Only individuals who had not previously used the software package were eligible for this study, and each subject could only participate for one software package.

Table 18 shows the demographic breakdown of the subjects in terms of gender, occupation and educational background. Table 19 shows the means and standard deviations of subjects' familiarity with computers.

Table 18
Subject Demographics - Pilot Study

Item	Frequency
GENDER	
Male	5
Female	8
OCCUPATION	
Manager	4
Clerk	3
Unemployed	3
Other	3
EDUCATION (LEVEL)	
High School	4
Some College or University	2
College or University Degree	6
Some Graduate Work	1
EDUCATION (BACKGROUND)	
Business	4
Arts	2
Science	2
Social Science	3
Other	2

n=13

Procedures

Subjects were invited, in groups of two, to a 45 minute demonstration of WordPerfect or Lotus, followed by a structured practice session. When they arrived at the training site, they were asked to complete a brief background questionnaire and sign a consent form.

The software demonstration was conducted by the researcher. An overview of the purpose of the software and its benefits to the user were given at the outset of the

Table 19
Familiarity with Computers - Pilot Study

Item	Mean[1]	Std. Dev.
FAM1 - Overall Familiarity	2.69	0.85
FAM2 - Apple PCs	1.46	0.78
FAM3 - IBM PCs	2.85	1.21
FAM4 - Minicomputers	1.95	1.34
FAM5 - Mainframes	1.46	0.78
FAM6 - Spreadsheets	2.08	1.32
FAM7 - Word Processing	2.23	1.16
FAM8 - Database Packages	1.46	0.66
FAM9 - Statistics	1.23	0.44
FAM10 - Graphics	1.46	0.97
FAM11 - Electronic Mail	1.15	0.37
FAM12 - Programming Languages	1.31	0.63
Actual Experience with Lotus	1.61	1.12
Actual Experience with WordPerfect	1.85	1.07

[1] 5 point scale: 1=Not at all Familiar; 5=Very Familiar

n=13

demonstration. Then the basic features of the package were demonstrated. The demonstration, while it followed a similar pattern across the different groups, was adjusted depending on the background of the participants and the questions they asked. This presented no problem from a research perspective since the only objective of this aspect of the study was to observe novices interacting with the computer. The subjects were provided with written notes to accompany the demonstration. These notes (presented in Appendix I) also formed the reference for the practice exercises that they completed after the training.

Following the demonstration, subjects were escorted to one of two rooms where they would work on the practice exercises. They were instructed to "think aloud" while they worked on the exercises, to talk to the camera about what they were doing and how they were feeling. During the practice session, the instructor moved between the two rooms answering questions. It was not appropriate to stay in the room for the entire session, as the presence of the instructor tended to inhibit the verbalizations.

Following the practice session (about 2 hours in length) the subjects were completely debriefed regarding the purpose of the study and thanked for their time.

Analysis

The videotapes from this study were used as the "raw material" for the development of structured modeling scripts. The researcher viewed all of the tapes, noting common behaviours or feelings which characterized the novice users and any especially compelling statements made by the subjects.

Four different modeling scripts were developed based on these observations: 2 each for WordPerfect and Lotus 1-2-3 (Appendix J). The modeling scripts combined the salient features and verbalizations of all the videos from the pilot study. However, a distinct progression was added to the scripted videos, so that the models would be seen to initially experience difficulty, but gradually gain some degree of skill and confidence.

Actors were recruited to play the role of the novices in each of the tapes. Each actor rehearsed for approximately three hours prior to the taping session.

During this process, minor revisions were made to the scripts in order to better fit the personality of the individual actors.

The videotapes were made at a local television studio, with the production assistance of their professional staff. We attempted to run each actor as smoothly through the script as possible and edit the raw tapes later. This provided some additional improvisational material as the actors (who were by no means computer experts) struggled to solve their own problems. However, the general framework of the original scripts was maintained in all cases.

Testing of Videotapes

The videotapes were tested as part of a series of training courses at a provincial government office. Twenty managers and professionals attended a two-day session covering WordPerfect and Lotus 1-2-3. The videotapes were introduced following the formal training process as a means of gaining some initial understanding of what they could expect to experience in attempting to use the computers themselves. Subjects were told that the videotapes had been made as part of an earlier study and represented actual novices using the computer for the first time.

The pilot testing indicated a number of problems with the tapes. First, the actors were not believable as real people in a real situation. This lack of credibility created the potential that the subjects would not view the models as similar to themselves, and that without this assumed similarity, the models' behaviour would not influence self-efficacy, outcome expectations or performance.

In addition, subjects were bored by the end of two videotapes. Each tape lasted approximately twenty minutes. During the first tape, subjects were fairly attentive and interested in the material. By the second tape, however, they were clearly bored. They started to fidget, read their notes, or play with the computers in front of them. One participant even left.

In order to deal with these concerns, two adjustments were made to the way the modeling videotapes were presented. First, the models were introduced as people demonstrating problems they had when they were first learning. Thus, subjects were not led to believe that these were the spontaneous verbalizations of actual training participants (which they would not believe on seeing the tapes), but were told that they were demonstrating real problems that they had, themselves, encountered as novices. This introduction was suggested by Bandura (personal communication, 1991) as a way of achieving the most perceived similarity given the material available.

Second, only one tape was shown for each software package. In order to deal with the problem of observer interest, it would have been necessary either to edit the original tapes, or to select one only. If the tapes were edited, very little of the models' actual interaction with the computer would have been demonstrated. Since observing the progression of the model from a position of struggling uncertainty to a position of greater confidence was a key feature of the modeling intervention, reducing the time with each model was deemed unacceptable. Thus, for each package, the videotape that best demonstrated the essential features of the particular package was chosen.

Main Study

Subjects

Ninety-five subjects were recruited to participate in the main study. The target population was managers and professionals with little prior computer experience who wanted to learn both WordPerfect and Lotus 1-2-3.

Of the 95 subjects who started the training program, seven did not complete the training due to work or health conflicts. Thus, the final sample included 88 subjects, distributed among the training groups as shown in Table 20[3].

The subjects, 45 women and 43 men, ranged in age from 20 to 67, with a mean of 39.5 years. They came from a variety of educational backgrounds. Seventy percent were employed in organizations with less than 200 employees, though the mean size of organization was 409.5. The subjects represented all levels of managers and professionals, from the executive level (21.5%) to first line management (16%) and professional (17%) positions. Three subjects were unemployed, and seeking managerial or professional positions. The subjects represented a variety of functional areas, including accounting and finance (17%); engineering, design, R&D (12.5%); marketing and sales (15%); human resources (3%); and general management (31%).

---

[3] The reader is also referred to Table 17 (page 117) for additional information on the distribution of subjects across the training groups.

Table 20
Distribution of Subjects
Across Training & Experimental Groups

LOTUS TRAINING

		ORDER OF PRESENTATION		
		Lotus First	Lotus Second	TOTAL
METHOD	Modeling	24	22	46
	Non-Modeling	18	24	42
	TOTAL	42	46	88

WORDPERFECT TRAINING

		ORDER OF PRESENTATION		
		WP First	WP Second	TOTAL
METHOD	Modeling	21	20	41
	Non-Modeling	25	22	47
	TOTAL	46	42	88

Table 21
Subject Demographics - Main Study

Item	Number	Percent
ORGANIZATIONAL LEVEL		
Executive	19	21.5%
Middle Management	13	14.8%
First Line Management	14	15.9%
Non-management	37	43.0%
No Response	5	5.7%
FUNCTIONAL AREA		
Accounting/Finance	15	17.0%
Engineering/Design/R&D	11	12.5%
Marketing/Sales	13	14.8%
Human Resources	3	3.4%
General Management	27	30.7%
Other	19	21.6%
EDUCATIONAL BACKGROUND		
Arts	14	15.9%
Science	11	12.5%
Social Science	11	12.5%
Business	38	43.2%
Other/No Response	14	15.9%
LEVEL OF EDUCATION		
Some High School	3	3.4%
Completed High School	18	20.4%
Some College or University	14	15.9%
College or University Degree	38	43.2%
Some Graduate School	5	5.7%
A Graduate Degree	10	11.4%
FIRM SIZE		
1-10	30	34.1%
11-50	19	21.6%
51-200	13	14.8%
300-900	6	6.8%
over 900	4	4.5%
No Response	16	18.2%

n=88

Subject demographic information is presented in Table 21.

Subject Recruitment

Advertisements were placed in the Business section of the local daily newspaper, in the campus newspaper and on a local radio station (Appendix K). The advertisements indicated that a two day course on WordPerfect and Lotus was being offered in conjunction with a research project and that managers and professionals were invited to attend. The cost to the participants was $50.

Potential subjects contacted the researcher to register for the course. At this point, an initial screening was conducted to ensure that the subjects met the criteria for inclusion in the study (managerial or professional, little experience). All of the subjects could be classed as managerial or professional. Some were unemployed, but seeking managerial or professional positions. In terms of prior experience, the subjects varied in the degree to which they had actually used a computer before, but all considered themselves to be computer novices and had no significant experience with WordPerfect or Lotus.

Subjects were informed that the purpose of the research was to understand how individuals learn to use computers and the difficulties that they encounter in trying to use new software. Thus, they were not aware of the experimental manipulation (the modeling tapes).

Once they had registered in the course (and had been screened for appropriateness) a registration package was sent to them. This package included the relevant information about the course - where and when it was held, as well as the background questionnaire. A research information sheet and consent form were also included in the package in accordance with regulations on the ethical treatment of research subjects.

The Trainer

A professional trainer was hired to conduct the training sessions. This was done to avoid potential biases in the results that might have been introduced had the researcher conducted the training. The individual hired had several years of experience in designing and conducting training in a large Canadian bank.

While it was not feasible for the trainer to be completely blind to the experimental manipulation (she showed the videotape to the subjects), she was unaware of the specific hypotheses of the study.

The Training Program

The following paragraphs describe each of the components of the two-day training program. Figure 12 shows the sequencing of these activities for the study participants.

Day 1: Introductory session. At the start of the first day of training, the researcher collected the background questionnaires and consent forms, explained the

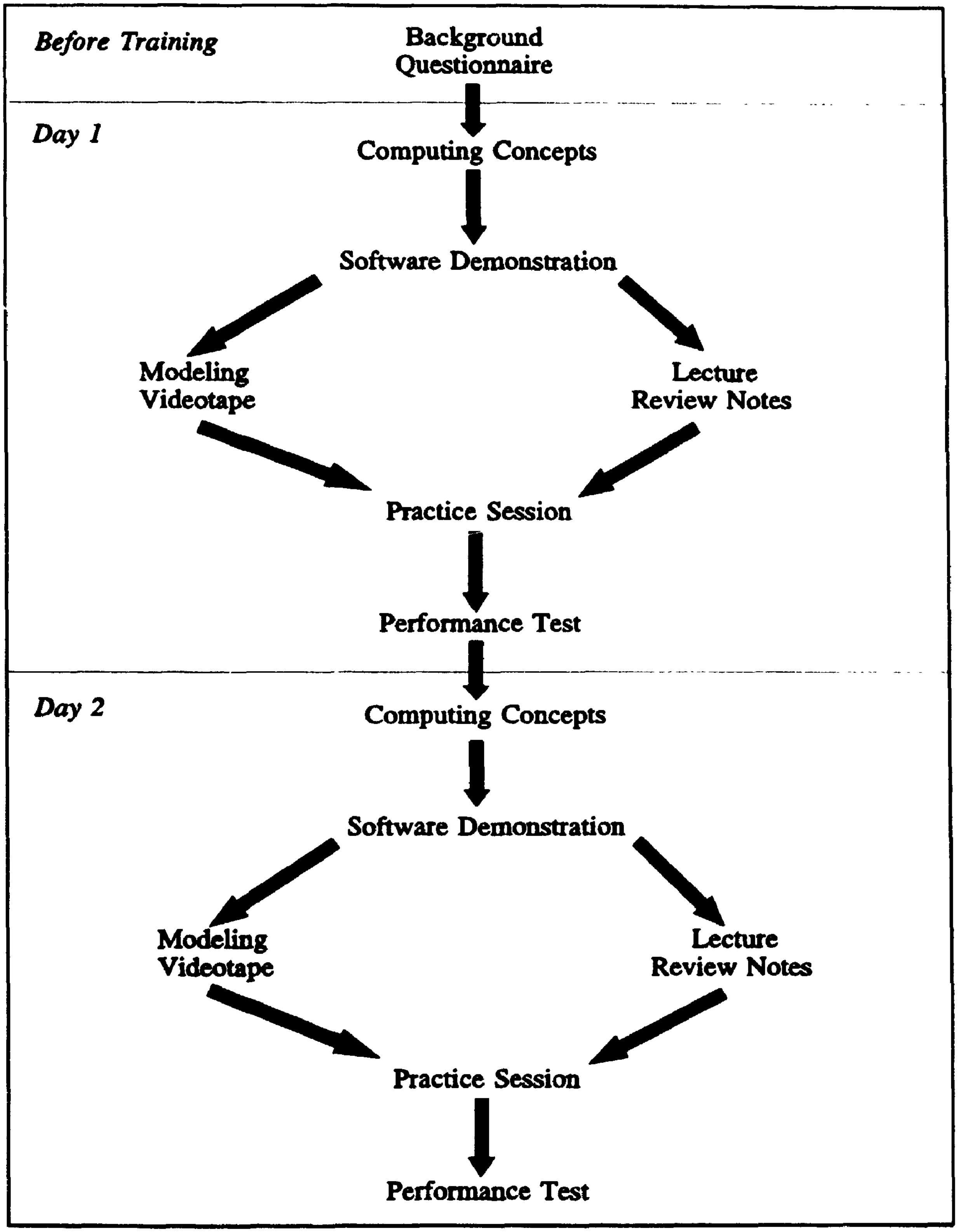


Figure 12. Chronology of Events - Main Study

purpose of the study (again in general terms) and answered any questions about the research. Questions that would have interfered with the manipulation were put off until the end of the course. The principles of confidentiality of the results were explained to the subjects. Then the schedule for the course was explained and the notes reviewed. The trainer was introduced to the subjects and the session turned over to her.

The trainer began by asking each of the subjects to introduce themselves and to talk about their background with computers and their specific hopes for the course. Following these introductions the trainer launched into the first session of the day.

Day 1: Computing concepts. This session was a brief introduction to computers and the Disk Operating System (DOS). In 40 minutes, the trainer described the major components of a computer system and the purpose (in general terms) of the operating system, and demonstrated the commands necessary to start the software packages running in the computer lab. (Appendix L shows the topics covered in the introductory session).

Day 1: Software demonstration. Following a 20 minute coffee break, the software demonstration was conducted. For 90 minutes, the trainer demonstrated how the program (Lotus or WordPerfect) was used and what features were available (not all features were shown). The trainer followed a fixed outline for covering the topics, but questions from participants were answered as they arose (or referred to the later section).

Day 1: Manipulation. Following the demonstration, a 45 minute lunch break was given. After lunch, the manipulation was introduced. Participants either saw the modeling videotape or had a brief lecture followed by thirty minutes to review their notes. The purpose of the lecture and review was to equalize the training time for the two groups. Since the modeling group received thirty minutes of instruction beyond the software demonstration (the videotape), the control group had to receive thirty minutes of additional instruction in order to equalize the training time. Had the control group gone immediately to the practice session, it would not be possible to separate the influence of the videotape from the influence of additional training time. Following the manipulation, the post-training questionnaire was administered.

Day 1: Practice lab. For two hours in the afternoon, subjects worked through the practice exercises. The instructor was present in the lab throughout this session to answer any questions. In order to ensure equal treatment of subjects across the training groups, the following rules were followed in answering questions. First, the instructor answered all questions by referring to the appropriate section of the subject's notes and talking through the instructions with him or her. Thus, no new material was provided through the questions. Second, the instructor did not provide unsolicited advice. For example, if a question was asked about one aspect of an exercise, the instructor confined her assistance to this question, even if she also noticed other mistakes in other aspects of the exercise. Again, this helped to avoid biasing the groups.

Day 1: Performance Test. After the two hour practice lab, the performance test was administered. The subjects had 70 minutes in which to complete the comprehension test and the hands on test (described below). After the test, they were thanked and excused for the day.

The instructor was not present during the performance tests and no questions, other than requests for clarification, were answered. However, for the benefit of the students, any questions they had about the performance test were answered after the test was complete. Thus, if they were particularly confused by something in the test, they had the opportunity to resolve it before they left for the day.

Day 2. On the second day of training, subjects were exposed to the second software package. The demonstration, manipulation, practice test and performance test were conducted in an identical fashion to that of day one. The material covered in the introductory session and computing concepts session is discussed in the following paragraphs.

Day 2: Introductory session. On the second day, the researcher discussed the need to maintain confidentiality about the program. Many of the subjects knew other people who would be attending training later, and thus they had the potential to bias these subjects by talking about their experiences. They were asked not to discuss the training with anyone else who would be attending, until after they had all been through the course. The participants understood this need, and were willing to cooperate.

Day 2: Computing concepts. On the second day, this session covered issues of computer security (backup, viruses, copyright) that subjects should know. This session was included based on the response to the pilot study and the videotape pretest. Subjects in both of these preliminary studies were keenly interested in understanding these issues and how they related to their own use of computers at work and at home.

Day 2: Conclusion of session. On the second day, at the conclusion of the performance test, subjects were debriefed about the purpose of the study and thanked for their participation. They were also given the follow up questionnaire to complete and return within a few days.

Materials

A variety of materials was required for the experiment. For the training program, a reference binder was developed to give to the students. The lecture was also developed specifically for the research, as were the practice exercises and the behaviour modeling videotapes.

Notes. The training notes were written for the novice user. Technical jargon was avoided, and an "applications focus" rather than a "features focus" was adopted. The notes are presented in Appendix M.

Practice Exercises. The practice exercises provided the subjects with an opportunity to work through some problems in order to familiarize themselves with the software. Step by step instructions on how to complete the task were given, as were specific references to sections of the notes where additional information could be found. The practice exercises are shown in Appendix N.

Comprehension Test. Paper and pencil comprehension tests (shown in Appendix O) were developed for Lotus and WordPerfect. The purpose of these tests was to gauge the subjects' ability to recall specific aspects of the training. The comprehension test used by Olfman and Bostrom (1990) in their study of Lotus 1-2-3 was used as a starting point for the development of the current tests. The comprehension test was scored according to a detailed key by an independent grader who was blind to the conditions of the experiment.

Timed Exercises. Two exercises were used for the performance test. The first exercise was designed to test basic concepts that had already been used in the practice exercises. The second exercise contained less explicit instruction, and required the subjects to do things that were somewhat different from the practice session, though not beyond their capability. Scoring was conducted by the same grader who scored the comprehension test, again according to a predetermined key. The timed exercises are shown in Appendix P.

Measures

Three questionnaires were used in data collection. A background questionnaire, completed prior to the training course, solicited information about prior experience, outcome expectations, self-efficacy, anxiety, support and encouragement as well as demographic data (Appendix Q). Following each day of training, a post-training questionnaire was administered to assess self-efficacy and outcome expectations (Appendix R). Finally, at the end of the two day course (after the performance test on day 2), a follow up questionnaire was administered to capture the subjects' reaction to the training and to retest their self-efficacy and outcome expectations (Appendix S).

Background Questionnaire. The measures used in this questionnaire were the same as those used in the national survey (see Chapter 3). A few modifications to this instrument were made, however, to more appropriately fit the research context.

Outcome expectations. The individual items designed to measure outcome expectations were not changed, however the construct was measured at 3 levels. The general level was identical to the questions asked in the national survey. Following these items, respondents were asked to consider the outcomes of using Lotus 1-2-3 and WordPerfect specifically. These measures permit testing of the relationships between self-efficacy, outcome expectations and behaviour at a more specific level of abstraction, consistent with the recommendations of Bandura (1986). Retention of the general level measure (use of computers) permitted comparisons across the different levels.

In the national survey, the outcome expectations measure was found to be multidimensional. Thus, factor analysis of the outcome expectations scale was conducted to determine the nature of the underlying factors. Principal components factor analyses were conducted, requesting one, two and three separate factors. The two and three factor solutions were found to be the best representation of the data (Appendix T provides further details on the results of this analysis).

In the two-factor solution, the first factor, which explained 60% percent of the variance in items, reflects the performance-related outcomes (e.g., increased productivity, increased effectiveness) of computer use. The second factor (which explained a further 36% of the item variance) reflects personal outcomes, such as improved status, promotions, a sense of accomplishment). In the three-factor solution, the personal outcomes tend to separate into externally derived, or tangible rewards (e.g., a promotion), and internally derived, intangible rewards (e.g., a sense of accomplishment).

This distinction between different sources of reward is consistent with theories of intrinsic and extrinsic reward, and should, ideally, be made. On the other hand, the two-factor solution explains a total of 96% of the variance in the items, indicating that the third factor adds little to the measure. Moreover, the loadings for the items which characterize factor three are only moderate (0.49-0.54), indicating that the measures do not capture the essence of the construct particularly well. Furthermore, the second and third factors consist of only 3 items each. While the three factor solution may be a more complete representation of the nature of outcome expectations, the current measure did not adequately capture and distinguish between the different dimensions, and as a result, only two factors (performance versus personal outcomes) were examined in the present research. Thus, for the purposes of the data analyses, outcome expectations were separated into Performance Outcome Expectations (items 1,5,8,9,10,11) and Personal Outcome Expectations (items 2,3,4,6,7).

Self-efficacy. Two changes were made to the self-efficacy scale. First, both general and specific (Lotus 1-2-3 and WordPerfect) self-efficacy was measured. Second, two items were dropped from the scale. These two items asked the respondent to consider whether he or she could complete the job using the software "if I had never used a package like it before" and "if I had used similar packages before to do the same job." In the case of specific measures, the respondent knows whether he or she has or has not used similar software. Thus, the two questions which would require the respondent to substitute a hypothetical past would be confusing for the respondents and meaningless for the research. While they could be retained for the general measure, for the sake of consistency, they were dropped completely.

Opportunity to use on the job. This scale was added to the survey to reflect a potentially constraining condition on the subjects' behaviour. If subjects did not have an opportunity to use the software in their current jobs, their motivation to learn might be lowered, even if they believed it would be beneficial (high outcome expectations) and within their abilities (high self-efficacy). The possible effect of this construct was suggested by Triandis (1980), who argued that even in the face of high motivation and intention to undertake a behaviour, facilitating conditions might make it impossible for the individual to act. Six items asked the respondents to consider whether they had the opportunity to use WordPerfect and Lotus in their current jobs.

Post-training questionnaire. Following the formal training session and manipulation each day, but before the practice session, respondents completed the post-training questionnaire. Outcome expectations, self-efficacy, and opportunity to use on the job were assessed in this instrument.

Opportunity to use was again included as a control variable. If subjects discovered during the course of training that the package was not applicable to their current job, their motivation might change, independent of their outcome expectations and self-efficacy. Alternatively, the change in opportunity to use might affect outcome expectations and thus performance.

Follow up questionnaire. At the end of the two day course, subjects were given a follow up questionnaire to take home and complete. This questionnaire included measures of outcome expectations, self-efficacy, affect, anxiety, opportunity to use on the job, and expected use, as well as questions designed to capture subjects ratings of the training.

Expected use was measured by two questions which asked the subjects to rate the frequency with which they believed they would use WordPerfect and Lotus 1-2-3. Reaction to the training was measured separately for each package. Three questions were included for each package. In the first question, subjects indicated the degree to which various aspects of the training (the lecture/demonstration, the training notes, the practice exercises) had been helpful or not helpful. The second question asked the respondents to rate the extent to which they believed the training had helped them become competent at using the software, and the third question asked them whether they would recommend this training to others as a way of learning the specific software package.

IV. Results

Descriptive Statistics

Self-efficacy Scores

Table 22 shows the mean self-efficacy scores for the Background Questionnaire through the two Post-training Questionnaires and the Follow Up Questionnaire. Both the general and specific (i.e. for each software package) measures of self-efficacy are shown for each of the two groups.

Repeated measures analysis of variance was conducted to see whether self-efficacy had indeed changed through the course of the training (Table 23). Six oneway analyses of variances were conducted, for general self-efficacy, WordPerfect self-efficacy and Lotus self-efficacy in each of the two groups (Lotus first/WordPerfect first). The overall tests showed significant differences between self-efficacy scores across time. As a follow up to the overall tests, the differences between specific means was assessed, using the Neuman-Keuls post hoc test

Table 22
Self-Efficacy Scores
at
Background, First Post-test, Second Post-Test, Follow Up

	N Cases	Background	Post 1	Post 2	Follow Up
Group 1 (Lotus/WP)					
• General					
Mean	35[†]	4.11_a[††]	5.28_b	5.47_b	5.25_b
Std. Dev.		1.98	1.87	1.91	2.19
• WP					
Mean	35	4.24_a	5.21_b	6.26_c	6.20_c
Std. Dev.		2.12	1.97	1.67	2.44
• Lotus					
Mean	35	3.59_a	5.93_b	6.26_b	5.44_b
Std. Dev.		1.96	1.44	1.67	2.65
Group 2 (WP/Lotus)					
• General					
Mean	40	4.14_a	5.11_b	5.25_b	5.33_b
Std. Dev.		2.36	2.29	2.26	2.35
• WP					
Mean	40	4.25_a	5.54_b	5.78_b	5.74_b
Std. Dev.		2.33	2.22	2.43	2.31
• Lotus					
Mean	40	3.70_a	4.34_b	5.24_c	5.52_c
Std. Dev.		2.31	2.35	2.33	2.61

[†] Only 75 people completed and returned the follow up survey. In order to ensure comparability across time, this table includes only the data from people who had completed all the questionnaires.

[††] Means in the same row with the same subscript do not differ at the 0.001 level. No comparisons are made across the rows.

(Table 24).

For the group which learned Lotus 1-2-3 first, the general self-efficacy scores increased between the background measurement and the first post measure (Lotus training), and then stayed constant from first and second post measures (WordPerfect

Table 23
Repeated Measures ANOVA of Self-Efficacy Scores

	Sum of Squares	df	F	p-level
Group 1 (Lotus/WP)				
• General Self-efficacy				
Effect	40.67	3	14.34	0.000
Error	96.42	102		
• WP				
Effect	95.76	3	23.87	0.000
Error	136.36	102		
• Lotus				
Effect	127.58	3	30.61	0.000
Error	141.68	102		
Group 2 (WP/Lotus)				
• General				
Effect	36.25	3	11.90	0.000
Error	118.79	117		
• WP				
Effect	63.42	3	17.91	0.000
Error	138.07	117		
• Lotus				
Effect	83.98	3	17.66	0.000
Error	185.47	117		

training). It remained constant between the second post measure and the follow up, to approximately the level of the second post measure. WordPerfect self-efficacy increased both following Lotus training and following WordPerfect training. It did not change from the second post measure to the follow up. Lotus self-efficacy increased following Lotus training and then stayed constant following WordPerfect training and through the follow up measure.

Table 24
Post Hoc Tests
Differences between Self-efficacy Scores

	Background - Post 1	Post 1 - Post 2	Post 2 - Follow Up
Group 1 (Lotus/WP)[1]			
• General	p<.001	n.s.	n.s.
• WP	p<.001	p<.001	n.s.
• Lotus	p<.001	n.s.	n.s.
Group 2 (WP/Lotus)[2]			
• General	p<.001	n.s.	n.s.
• WP	p<.001	n.s.	n.s.
• Lotus	p<.001	p<.001	n.s.

[1] n=35
[2] n=40

For the group who learned WordPerfect first a similar pattern was found. General self-efficacy increased from background questionnaire to first post measure (WordPerfect training) and then stayed constant through the second post measure and the follow up. WordPerfect self-efficacy increased following WordPerfect training and then stayed constant following Lotus training (second post measure) and from second post measure to follow up. Lotus self-efficacy increased both after WordPerfect training and after Lotus training, and then stayed through the follow up.

These patterns suggest that training in either WordPerfect or Lotus influenced the development of self-efficacy with respect to the package. Self-efficacy regarding the other package increased, but only if the other training had not yet occurred, suggesting that self-efficacy perceptions are somewhat generalizable across software packages. Self-efficacy about computers in general increased following the first day of training, but then stayed constant. This finding confirms Bandura's view that self-efficacy should be in the context of the specific behaviour of interest, in order to maximize understanding and prediction.

Performance Scores

Table 25 shows the subjects' scores on the comprehension and performance tests (expressed as percentages for comparability). Overall, the scores were quite low. For WordPerfect comprehension, the overall average score was 32%, and for the WordPerfect performance test, the overall average score was 55%. The Lotus

Table 25
Performance Scores

	WordPerfect		Lotus	
	Comprehension	Performance	Comprehension	Performance
Group 1 (Lotus/WP)				
• Mean	35.5	54.3	54.9	35.0
• Std. Deviation	18.9	25.2	20.9	26.3
• N Cases	42	42	42	42
Group 2 (WP/Lotus)				
• Mean	29.4	55.5	51.6	33.6
• Std. Deviation	21.0	23.5	19.6	23.1
• N Cases	46	46	46	46
OVERALL				
• Mean	32.3	55.0	53.2	34.2
• Std. Deviation	20.2	24.2	20.1	24.6
• N Cases	88	88	88	88

scores were also low (overall average comprehension = 53%; overall average performance score = 34%).

It should also be noted that subjects scored substantially lower on the Lotus performance tests than on the WordPerfect performance tests (the reverse was true for comprehension). Thus, subjects seemed to have more difficulty learning Lotus than they did learning WordPerfect. This finding is not surprising, but does have some implications for the interpretation of the results.

The Research Model

The research model was analyzed using Partial Least Squares (PLS). Separate models were needed for each of the software packages, since the measures of self-efficacy, outcome expectations and performance were all specific to the particular package. In addition, prior performance data were only available for the second day of training (day 1 performance was used as the measure), so the full model could only be tested for the day 2 training data. A subset of the model (including all of the relationships except those pertaining to prior experience) was tested using the data from day 1 training.

Thus, four PLS models were analyzed as follows:

Model 1: Lotus, Day 1
Model 2: WordPerfect, Day 1
Model 3: Lotus, Day 2
Model 4: WordPerfect, Day 2.

The analysis proceeded in two phases. First, it was necessary to establish a common measurement base for the four models and to assess the properties of the measurement models. Establishing a common measurement base was important since the meaning (in a theoretical sense) of constructs in a structural equations model is determined (empirically) by the measures associated with them. Since different models may result in very different constructs (by virtue of different loadings of measures on the constructs) and since these variations might have serious consequences for the conclusions of the study, it was necessary to find a set of measures which would be adequate for all four of the models.

Even with a common set of measures, substantial differences in the loadings might influence the paths in the structural model. Minor discrepancies would not have a substantial impact on the findings, but large differences could present a problem. Thus, consistency in the magnitude of the loadings across the four models was also sought.

Initial Models

Model 1. Lotus - Day 1. The initial run of this model indicated several problems in measurement (Table 26 & Table 27). The performance construct, in particular, was problematic. All of the loadings were low, but while comprehension (the paper and pencil test) loaded positively, the hands on performance tests showed negative loadings.

Table 26
Lotus Session 1 - Original Model
LV Loading Structure Matrix

	Modeling	Lotus Self-efficacy	Perf. Outcome Expectations	Personal Outcome Expectations	Performance
Modeling	1.000	-0.400	-0.017	0.211	0.123
P1LCSE1	-0.289	0.757	0.258	0.134	-0.[illegible]1
P1LCSE2	-0.245	0.658	0.240	0.137	0.0o2
P1LCSE3	-0.204	0.766	0.390	0.316	0.014
P1LCSE4	-0.322	0.888	0.306	0.165	0.009
P1LCSE5	-0.384	0.908	0.563	0.355	-0.088
P1LCSE6	-0.419	0.800	0.418	0.246	0.003
P1LCSE7	-0.312	0.769	0.395	0.217	0.229
P1LCSE8	-0.355	0.888	0.470	0.256	-0.079
P1LOUT1	-0.057	0.125	0.375	0.278	-0.166
P1LOUT5	-0.000	0.506	0.849	0.460	0.225
P1LOUT8	0.023	0.377	0.809	0.363	0.222
P1LOUT9	0.023	0.388	0.892	0.458	0.221
P1LOUT10	-0.000	0.380	0.842	0.317	0.319
P1LOUT11	0.079	0.412	0.822	0.349	0.187
P1LOUT2	-0.002	0.076	0.258	0.671	0.266
P1LOUT3	0.228	0.139	0.411	0.087	0.206
P1LOUT4	0.248	0.277	0.458	0.912	0.241
P1LOUT6	0.235	0.213	0.289	0.869	0.317
P1LOUT7	0.170	0.336	0.464	0.886	0.265
LOTCOMP	-0.208	0.203	0.281	0.146	0.459
LOTPERF1	-0.321	0.200	0.036	-0.150	-0.446
LOTPERF2	-0.202	0.121	0.027	-0.018	-0.134

The outcome expectations constructs also displayed some weakness in measurement. Five of the six measures of performance outcome expectations had high loadings ($\lambda > 0.80$), but the sixth was only weakly correlated ($\lambda = 0.375$). This item ("If I use a computer...I will be more organized") reflects a slightly different type of outcome than the others (which focused more specifically on performance

Table 27
Lotus Session 1 - Original Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR[†]	1.	2.	3.	4.	5.
1. Modeling	.	1.00				
2. Self-efficacy	0.94	-0.40	0.81			
3. Performance Outcome Expectations	0.90	-0.02	0.49	0.79		
4. Personal Outcome Expectations	0.84	0.21	0.30	0.47	0.75	
5. Performance	0.00	0.12	0.01	0.28	0.32	0.37

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

outcomes such as productivity and effectiveness), so the lower loading is not entirely surprising.

For personal outcome expectations, all but one of the measures were adequate. Item 3 ("If I use a computer...I will feel a sense of accomplishment") had a loading of only $\lambda=0.087$, indicating it was not related to the other measures. Here again, the other measures represent somewhat different outcomes (such as getting a raise or a promotion) which may account for the low loading.

The self-efficacy construct displayed no problems in measurement. High loadings of all items, coupled with high reliability (Cronbach's $\alpha=0.94$) indicated that the measure of Lotus self-efficacy was adequate.

Table 28
WordPerfect (WP) Session 1 - Original Model
LV Loading Structure Matrix

	Modeling	WP Self-efficacy	Perf. Outcome Expectations	Personal Outcome Expectations	Performance
Modeling	**1.000**	0.019	-0.163	-0.239	0.064
P1WCSE1	-0.007	**0.832**	0.260	0.185	0.537
P1WCSE2	-0.001	**0.849**	0.237	0.166	0.539
P1WCSE3	0.009	**0.878**	0.404	0.116	0.522
P1WCSE4	-0.041	**0.856**	0.446	0.223	0.624
P1WCSE5	0.062	**0.868**	0.487	0.081	0.546
P1WCSE6	-0.025	**0.886**	0.303	0.013	0.615
P1WCSE7	0.087	**0.848**	0.296	0.063	0.607
P1WCSE8	0.053	**0.738**	0.316	0.019	0.460
P1WOUT1	-0.060	0.334	**0.874**	0.381	0.030
P1WOUT5	-0.160	0.296	**0.860**	0.419	0.096
P1WOUT8	-0.116	0.467	**0.862**	0.197	0.216
P1WOUT9	-0.237	0.366	**0.931**	0.489	0.113
P1WOUT10	-0.149	0.337	**0.856**	0.247	0.061
P1WOUT11	-0.016	0.104	**0.528**	0.176	0.068
P1WOUT2	-0.218	0.098	0.257	**0.851**	0.034
P1WOUT3	-0.243	0.052	0.379	**0.620**	-0.021
P1WOUT4	-0.172	0.098	0.288	**0.830**	-0.006
P1WOUT6	-0.135	0.086	0.178	**0.841**	-0.044
P1WOUT7	-0.159	0.179	0.383	**0.846**	0.072
WPCOMP	0.037	0.604	0.088	0.081	**0.921**
WPPERF1	-0.056	0.460	0.102	-0.040	**0.689**
WPPERF2	0.161	0.514	0.149	-0.085	**0.768**

Model 2. WordPerfect - Day 1. Overall this model was more stable and displayed fewer problems than model 1. The self-efficacy construct, again, displayed high loadings and high reliability. Both outcome expectations constructs had more consistent loadings than was the case for the previous model, although some problems still existed. Item 11 ("If I use a computer...I will be less reliant on clerical

support") had a loading of only λ=0.528. For personal outcome expectations, item 3 again had a lower loading (λ=0.62) though not as low as for the earlier model. Finally, while the performance items all loaded positively in this model, the loading for comprehension was substantially higher than the loadings for either of the hands on performance tests.

Table 29
WordPerfect (WP) Session 1 - Original Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR[†]	1.	2.	3.	4.	5.
1. Modeling	.	1.00				
2. Self-efficacy	0.95	0.02	0.84			
3. Performance Outcome Expectations	0.93	-0.16	0.41	0.83		
4. Personal Outcome Expectations	0.90	-0.24	0.13	0.38	0.80	
5. Performance	0.84	0.06	0.66	0.13	0.01	0.80

[†] Internal Consistency Reliability

[**] Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table 28 shows the factor structure matrix, and Table 29 shows the reliability and discriminant validity coefficients for this model.

Model 3. Lotus - Day 2. This model, as was noted earlier, included prior experience as an antecedent to self-efficacy, outcome expectations and performance on day 2. Prior experience was operationalized in terms of performance on the package learned on day 1. Thus, an individual's comprehension score and performance test scores on the first software package learned were used as a measure of his or her prior experience with computers.

The initial model run was adequate from a measurement standpoint, but indicated similar weaknesses to the Day 1 models (Table 30 & Table 31). For performance outcome expectations, item 11 again had a lower loading ($\lambda=0.69$) and for personal outcome expectations item 3 was weak ($\lambda=0.53$). All other constructs were adequate in terms of measurement.

Table 31
Lotus Session 2 - Original Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.
1. Prior Performance	0.85	0.81					
2. Modeling	.	0.05	1.00				
3. Self-efficacy	0.97	0.58	-0.16	0.88			
4. Perf. Outcome Exp.	0.94	0.14	-0.24	0.42	0.85		
5. Personal Outcome Exp.	0.90	0.01	-0.26	0.16	0.37	0.81	
6. Performance	0.83	0.64	-0.04	0.46	-0.05	-0.36	0.79

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table 30
Lotus Session 2 - Original Model
LV Loading Structure Matrix

	Prior Performance	Modeling	Self-efficacy	Perf. O.E.	Personal O.E.	Performance
WPCOMP	**0.837**	0.103	0.564	0.178	0.120	0.448
WPPERF1	**0.814**	0.109	0.473	0.079	-0.005	0.525
WPPERF2	**0.777**	-0.113	0.346	0.064	-0.130	0.599
Modeling	0.55	**1.000**	-0.160	-0.245	-0.262	-0.040
P2LCSE1	0.499	-0.148	**0.901**	0.358	0.185	0.400
P2LCSE2	0.515	-0.085	**0.882**	0.306	0.138	0.430
P2LCSE3	0.469	-0.75	**0.887**	0.394	0.103	0.359
P2LCSE4	0.599	-0.197	**0.882**	0.341	0.219	0.402
P2LCSE5	0.500	-0.194	**0.939**	0.502	0.143	0.427
P2LCSE6	0.534	-0.132	**0.876**	0.284	0.212	0.396
P2LCSE7	0.453	0.077	**0.826**	0.339	0.099	0.300
P2LCSE8	0.505	-0.299	**0.866**	0.422	0.009	0.477
P2LOUT1	-0.052	-0.209	0.126	**0.816**	0.258	-0.188
P2LOUT5	0.088	-0.134	0.310	**0.808**	0.497	-0.103
P2LOUT8	0.259	-0.230	0.543	**0.915**	0.240	0.031
P2LOUT9	0.159	-0.252	0.397	**0.931**	0.380	0.020
P2LOUT10	0.074	-0.300	0.346	**0.916**	0.297	0.015
P2LOUT11	0.020	-0.077	0.247	**0.699**	0.251	-0.157
P2LOUT2	-0.010	-0.230	0.077	0.267	**0.857**	-0.323
P2LOUT3	0.212	-0.244	0.212	0.389	**0.534**	-0.047
P2LOUT4	-0.058	-0.143	0.082	0.280	**0.863**	-0.390
P2LOUT6	-0.063	-0.247	0.131	0.268	**0.856**	-0.266
P2LOUT7	0.043	-0.236	0.185	0.359	**0.868**	-0.330
LOTCOMP	0.569	-0.113	0.439	-0.022	-0.267	**0.885**
LOTPERF1	0.544	0.028	0.357	-0.058	-0.353	**0.858**
LOTPERF2	0.407	-0.310	0.355	0.009	-0.052	**0.614**

Model 4. WordPerfect - Day 2. Similar results were found for the WordPerfect participants (Table 32 & Table 33). Items 11 and 3 for Performance and Personal outcome expectations were weak ($\lambda=0.425$ and $\lambda=0.503$ respectively),

Table 32
WordPerfect (WP) Session 2 - Original Model
LV Loading Structure Matrix

	Prior Performance	Modeling	Self-efficacy	Perf. O.E.	Personal O.E.	Performance
LOTCOMP	**0.928**	-0.055	0.156	-0.190	-0.109	0.548
LOTPERF1	**0.620**	-0.034	0.052	-0.083	-0.390	0.317
LOTPERF2	**0.790**	0.055	0.115	-0.122	-0.209	0.456
Modeling	-0.013	**1.000**	0.177	-0.144	-0.188	0.301
P2WCSE1	0.049	0.281	**0.756**	-0.241	0.057	0.383
P2WCSE2	0.267	0.198	**0.747**	-0.305	-0.120	0.491
P2WCSE3	0.123	0.143	**0.870**	-0.064	0.103	0.386
P2WCSE4	0.203	-0.002	**0.808**	-0.086	0.062	0.430
P2WCSE5	0.169	0.132	**0.830**	-0.008	0.116	0.379
P2WCSE6	0.021	0.039	**0.750**	-0.220	0.062	0.423
P2WCSE7	0.072	0.140	**0.761**	-0.065	0.007	0.390
P2WCSE8	0.069	0.149	**0.803**	-0.004	0.176	0.344
P2WOUT1	-0.212	0.048	-0.124	**0.709**	0.251	-0.361
P2WOUT5	-0.084	-0.227	-0.076	**0.873**	0.396	-0.352
P2WOUT8	-0.134	-0.007	0.018	**0.745**	0.375	-0.189
P2WOUT9	0.082	0.064	0.121	**0.640**	0.306	0.014
P2WOU10	-0.082	0.092	0.291	**0.277**	0.249	0.143
P2WOUT11	-0.014	-0.093	0.119	**0.425**	0.521	-0.114
P2WOUT2	-0.148	-0.169	-0.030	0.154	**0.827**	-0.251
P2WOUT3	-0.170	0.003	-0.035	0.397	**0.503**	-0.201
P2WOUT4	-0.085	-0.229	0.068	0.460	**0.834**	-0.114
P2WOUT6	-0.071	-0.083	0.132	0.297	**0.859**	-0.100
P2WOUT7	-0.095	-0.190	0.111	0.436	**0.812**	-0.080
WPCOMP	0.396	0.003	0.065	-0.078	-0.199	**0.339**
WPPERF1	0.477	0.243	0.403	-0.273	-0.069	**0.741**
WPPERF2	0.399	0.250	0.431	-0.506	-0.190	**0.810**

and the magnitude of the loadings for the comprehension and hands-on performance tests were quite different. In addition, item 10 for Performance Outcome Expectations had a low loading ($\lambda = 0.277$) and a high cross loading with both self-efficacy and personal outcome expectations.

Table 33
WordPerfect (WP) Session 2 - Original Model Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.
1. Prior Performance	0.83	**0.79**					
2. Modeling	.	-0.13	**1.00**				
3. Self-efficacy	0.93	0.16	0.18	**0.79**			
4. Perf. Outcome Exp.	0.79	-0.19	-0.14	-0.18	**0.64**		
5. Personal Outcome Exp.	0.88	-0.15	-0.19	0.06	0.44	**0.78**	
6. Performance	0.68	0.59	0.30	0.52	-0.50	-0.20	**0.66**

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Revisions to the Models

Based on the preceding analyses, several modifications to the measurement and structural model were made. First, items 1, 10 and 11 were dropped from the performance outcome expectations construct and item 3 was dropped from the personal outcome expectations construct. While ordinarily it would be inappropriate to simply drop measures (especially since they had been successfully used in Study 1), it was necessary in this instance in order to ensure reasonable consistency in the construct meanings across the four models.

The other changes in the models involved splitting the performance construct into two separate constructs. Three of the four models indicated strongly that comprehension and hands on performance were related to overall performance in different ways. From a theoretical perspective as well, comprehension and performance appear to reflect different types of learning. Comprehension involves the ability to recall particular commands and features of the software, while performance relied less on rote recall (subjects had the use of their notes) and more on the ability to apply the concepts to novel situations. Thus, for subsequent models, comprehension and performance were represented as two separate constructs.

With two separate performance constructs in the model, it was necessary to specify the relationship between them. Two plausible possibilities existed. First, one could hypothesize, as was the case for outcome expectations, that comprehension and performance were simply lower level dimensions of a broader construct, which would be correlated but not causally connected. Second, it could be argued that comprehension is antecedent to performance, in that some degree of basic recall would be a necessary though not sufficient condition for performance. Even though subjects had the use of their notes for reference, they would need to have some recall of what to look for in order to carry out the performance tasks.[4]

The second relationship seemed most consistent with prior literature and was thus adopted. This gave rise to a new hypothesis, and involved splitting other

---

[4] A third possibility, that performance was antecedent to comprehension, was rejected since no adequate rationale for this relationship could be found, and since the performance test was conducted after the comprehension test in the experiment.

hypotheses to reflect the different influences of comprehension and performance. The new hypothesis is as follows:

> **H10. An individual's comprehension of the software influences his/her ability to use the package (hands on performance).**

Tests of the Revised Models

Tables 34 to 41 show the measurement statistics for the revised models. The structure matrices indicate high and consistent loadings for all measures and no unusually high cross-loadings. All of the constructs possess adequate reliability (Tables 35, 37, 39, and 41). These tables also show the discriminant validity coefficients for the models. As discussed in Chapter Three, these tables allow comparison of the square root of the variance shared between constructs and their measures (the diagonal elements) and the constructs themselves (the off-diagonal elements). Since none of the off-diagonal elements exceeds the respective diagonal element, the criteria for discriminant validity were considered satisfied.

Table 34
Lotus Session 1 - Revised Model
LV Loading Structure Matrix

	Modeling	Self-efficacy	Perf. O.E.	Personal O.E.	Comprehension	Performance
Modeling	**1.000**	-0.397	0.000	0.230	-0.208	-0.315
P2LCSE1	-0.289	**0.775**	0.274	0.143	0.263	0.321
P2LCSE2	-0.245	**0.675**	0.239	0.127	0.170	0.171
P2LCSE3	-0.204	**0.774**	0.396	0.335	0.179	0.168
P2LCSE4	-0.322	**0.890**	0.311	0.172	0.188	0.189
P2LCSE5	-0.384	**0.897**	0.553	0.347	0.036	0.105
P2LCSE6	-0.419	**0.794**	0.398	0.232	0.203	0.183
P2LCSE7	-0.312	**0.766**	0.370	0.226	0.279	0.080
P2LCSE8	-0.355	**0.877**	0.464	0.266	0.097	0.131
P2LOUT5	0.000	0.497	**0.859**	0.466	0.241	0.026
P2LOUT8	-0.023	0.371	**0.880**	0.362	0.339	0.144
P2LOUT9	0.023	0.382	**0.900**	0.449	0.265	0.084
P2LOUT2	0.002	0.071	0.208	**0.607**	0.038	-0.133
P2LOUT4	0.248	0.272	0.513	**0.932**	0.172	-0.034
P2LOUT6	0.235	0.208	0.264	**0.846**	0.005	-0.262
P2LOUT7	0.170	0.332	0.529	**0.911**	0.205	-0.026
LOTCOMP	-0.208	0.211	0.319	0.143	**1.000**	0.623
LOTPERF1	-0.321	0.206	0.096	-0.138	0.588	**0.962**
LOTPERF2	-0.202	0.132	0.061	-0.032	0.509	**0.775**

Table 35
Lotus Session 1 - Revised Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.
1. Modeling	.	**1.00**					
2. Self-efficacy	0.94	-0.40	**0.81**				
3. Perf. Outcome Exp.	0.91	0.00	0.48	**0.88**			
4. Personal Outcome Exp.	0.90	0.23	0.29	0.49	**0.83**		
5. Comprehension	.	-0.21	0.21	0.32	0.14	**1.00**	
6. Performance	0.86	0.31	0.20	0.09	-0.12	0.62	**0.87**

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table 36
WordPerfect (WP) Session 1 - Revised Model
LV Loading Structure Matrix

	Modeling	Self-efficacy	Perf. O.E.	Personal O.E.	Comprehension	Performance
Modeling	**1.000**	0.018	-0.186	-0.199	0.037	0.081
P2WCSE1	-0.007	**0.835**	0.268	0.196	0.469	0.496
P2WCSE2	-0.001	**0.851**	0.277	0.175	0.515	0.439
P2WCSE3	0.009	**0.877**	0.413	0.140	0.480	0.449
P2WCSE4	-0.041	**0.855**	0.467	0.223	0.570	0.538
P2WCSE5	0.062	**0.865**	0.513	0.073	0.532	0.429
P2WCSE6	-0.025	**0.888**	0.311	0.032	0.510	0.604
P2WCSE7	0.087	**0.849**	0.307	0.073	0.590	0.480
P2WCSE8	0.053	**0.736**	0.295	0.009	0.391	0.439
P2WOUT5	-0.160	0.294	**0.888**	0.354	0.123	0.035
P2WOUT8	-0.116	0.465	**0.883**	0.153	0.177	0.213
P2WOUT9	-0.237	0.364	**0.944**	0.425	0.129	0.064
P2WOUT2	-0.218	0.097	0.250	**0.848**	0.104	-0.066
P2WOUT4	-0.172	0.099	0.277	**0.889**	0.037	-0.063
P2WOUT6	-0.135	0.088	0.174	**0.842**	0.009	-0.101
P2WOUT7	-0.159	0.179	0.392	**0.902**	0.176	-0.082
WPCOMP	0.037	0.604	0.162	0.108	**1.000**	0.590
WPPERF1	-0.056	0.462	0.075	-0.040	0.485	**0.799**
WPPERF2	0.161	0.514	0.136	-0.101	0.519	**0.897**

Table 37
WordPerfect (WP) Session 1 - Revised Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.
1. Modeling	.	1.00					
2. Self-efficacy	0.95	0.02	0.84				
3. Perf. Outcome Exp.	0.93	-0.19	0.43	0.90			
4. Personal Outcome Exp.	0.93	-0.20	0.14	0.33	0.87		
5. Comprehension	.	0.04	0.60	0.16	0.11	1.00	
6. Performance	0.94	0.08	0.57	0.13	-0.09	0.59	0.85

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table 38
Lotus Session 2 - Revised Model
LV Loading Structure Matrix

	Prior Comp.	Prior Perf.	Modeling	Self-efficacy	Performance O.E.	Personal O.E.	Comp.	Perf.
WPCOMP	**1.000**	0.590	0.103	0.564	0.267	0.102	0.382	0.406
WPPERF1	0.485	**0.812**	0.109	0.473	0.086	-0.030	0.450	0.432
WPPERF2	0.519	**0.888**	-0.113	0.346	0.107	-0.159	0.519	0.506
Modeling	0.103	-0.018	**1.000**	-0.159	-0.228	-0.248	-0.113	-0.182
P2LCSE1	0.509	0.403	-0.148	**0.902**	0.394	0.166	0.394	0.346
P2LCSE2	0.507	0.413	-0.085	**0.883**	0.342	0.116	0.450	0.365
P2LCSE3	0.504	0.349	-0.075	**0.890**	0.460	0.094	0.377	0.372
P2LCSE4	0.590	0.497	-0.197	**0.882**	0.370	0.199	0.364	0.396
P2LCSE5	0.496	0.397	-0.194	**0.939**	0.557	0.120	0.391	0.367
P2LCSE6	0.474	0.458	-0.132	**0.874**	0.326	0.197	0.353	0.390
P2LCSE7	0.461	0.339	0.077	**0.824**	0.375	0.083	0.275	0.232
P2LCSE8	0.437	0.445	-0.299	**0.865**	0.447	-0.005	0.472	0.425
P2LOUT5	0.228	-0.031	-0.134	0.310	**0.889**	0.471	-0.044	-0.066
P2LOUT8	0.279	0.208	-0.230	0.544	**0.933**	0.213	0.064	0.069
P2LOUT9	0.223	0.099	-0.252	0.396	**0.945**	0.343	0.021	-0.026
P2LOUT2	0.073	-0.097	-0.230	0.076	0.227	**0.856**	-0.275	-0.245
P2LOUT4	0.057	-0.133	-0.143	0.083	0.335	**0.872**	-0.265	-0.207
P2LOUT6	0.026	-0.125	-0.247	0.130	0.253	**0.865**	-0.221	-0.184
P2LOUT7	0.189	-0.064	-0.236	0.186	0.408	**0.875**	-0.208	-0.172
LOTCOMP	0.382	0.611	-0.113	0.439	0.022	-0.280	**1.000**	0.680
LOTPERF	0.404	0.542	0.028	0.356	-0.041	-0.370	0.522	**0.830**
LOTPERF	0.303	0.421	-0.310	0.356	0.035	-0.059	0.637	**0.885**

Table 39
Lotus Session 2 - Revised Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.	7.	8.
1. Prior Comp.	.	1.00							
2. Prior Perf.	0.84	0.59	0.85						
3. Modeling	.	0.10	-0.02	1.00					
4. Self-efficacy	0.97	0.56	0.47	-0.16	0.88				
5. Perf. Outcome Exp.	0.94	0.27	0.11	-0.23	0.47	0.92			
6. Personal O.E.	0.92	0.10	-0.12	-0.25	0.14	0.35	0.87		
7. Comprehension	.	0.38	0.61	-0.11	0.44	0.02	-0.28	1.00	
8. Performance	0.85	0.41	0.55	-0.18	0.41	0.00	-0.23	0.68	0.86

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table 40
WordPerfect (WP) Session 2 - Revised Model
LV Loading Structure Matrix

	Prior Comp.	Prior Perf.	Modeling	Self-efficacy	Performance O.E.	Personal O.E.	Comp.	Perf.
LOTCOMP	1.000	0.622	-0.55	0.156	-0.081	-0.078	0.360	0.523
LOTPERF1	0.588	0.913	-0.034	0.055	-0.078	-0.363	0.371	0.273
LOTPERF2	0.509	0.858	0.055	0.111	-0.142	-0.196	0.347	0.418
Modeling	-0.055	0.006	1.000	0.175	-0.183	-0.198	0.003	0.314
P2WCSE1	0.007	-0.020	0.281	0.752	-0.152	0.068	0.009	0.397
P2WCSE2	0.232	0.128	0.198	0.734	-0.198	-0.107	0.107	0.495
P2WCSE3	0.147	0.062	0.143	0.875	0.043	0.155	0.096	0.391
P2WCSE4	0.163	0.122	-0.002	0.811	0.012	0.081	-0.090	0.460
P2WCSE5	0.173	0.207	0.132	0.839	0.043	0.120	0.107	0.384
P2WCSE6	0.057	0.073	0.039	0.744	-0.142	0.052	0.070	0.421
P2WCSE7	0.051	-0.041	0.140	0.761	0.028	0.022	0.106	0.388
P2WCSE8	0.116	0.013	0.149	0.816	0.076	0.209	-0.011	0.368
P2WOUT5	-0.041	-0.095	-0.227	-0.067	0.980	0.388	-0.086	-0.346
P2WOUT8	-0.126	-0.135	-0.007	0.023	0.874	0.365	0.091	-0.192
P2WOUT9	0.056	-0.009	0.064	0.122	0.741	0.269	0.106	0.004
P2WOUT2	-0.143	-0.296	-0.169	-0.026	0.115	0.796	-0.243	-0.222
P2WOUT4	-0.005	-0.244	-0.229	0.077	0.506	0.875	-0.150	-0.091
P2WOUT6	-0.080	-0.297	-0.083	0.134	0.288	0.855	-0.198	-0.066
P2WOUT7	-0.028	-0.264	-0.190	0.119	0.480	0.865	-0.095	-0.056
WPCOMP	0.360	0.406	0.003	0.064	-0.043	-0.205	1.000	0.199
WPPERF1	0.487	0.289	0.243	0.403	-0.127	-0.034	0.224	0.777
WPPERF2	0.337	0.306	0.250	0.425	-0.394	-0.169	0.091	0.795

Table 41
WordPerfect (WP) Session 2 - Revised Model
Reliability and Discriminant Validity Co-efficients

CONSTRUCT	ICR†	1.	2.	3.	4.	5.	6.	7.	8.
1. Prior Comp.	.	**1.00**							
2. Prior Perf.	0.88	0.62	**0.88**						
3. Modeling	.	-0.05	0.01	1.00					
4. Self-efficacy	0.93	0.16	0.09	0.17	**0.79**				
5. Perf. Outcome Exp.	0.90	-0.08	-0.12	-0.18	-0.05	**0.87**			
6. Personal O.E.	0.91	-0.08	-0.32	-0.20	0.09	0.40	**0.85**		
7. Comprehension	.	0.36	0.41	0.00	0.06	-0.04	-0.20	1.00	
8. Performance	0.76	0.52	0.38	0.31	0.53	-0.33	-0.13	0.20	**0.78**

† Internal Consistency Reliability

** Diagonal elements (shaded) represent the square root of the variance shared be ween the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Hypothesis Testing

Tables 42 and 43 show the results of the hypothesis testing for the revised models. Both a summary of support (Table 42) and the specific path coefficients (Table 43) are shown. The following sections summarize the findings with respect to each hypothesis.

H1. Modeling → Self-efficacy. This hypothesis was supported for the Lotus data but not for the WordPerfect data. That is, modeling training resulted in higher self-efficacy than non-modeling training when Lotus was being taught, but not when WordPerfect was being taught. This finding occurred regardless of whether Lotus was taught first or second.

H2. Modeling → Outcome expectations. Modeling training was found to significantly enhance performance outcome expectations for two of the four models, and personal outcome expectations for three of the four models. The paths (Table 43) indicated that subjects in the modeling sessions developed higher outcome expectations than subjects in the non-modeling sessions. For WordPerfect on Day 2, the relationship between modeling and performance outcome expectations was in the direction predicted by the hypothesis, but was not significant. The reason for the negative relationship between modeling and outcome expectations for the Lotus Day 1 model was not clear.

Table 42
Summary of Hypotheses

Hypothesis	Model 1 (Lotus 1)	Model 2 (WP 1)	Model 3 (Lotus 2)	Model 4 (WP 2)
H1: Modeling → Self-efficacy	✓	n.s.	✓	×
H2a: Modeling → Job O.E.	×	✓	✓	n.s.
H2b: Modeling → Personal O.E.	×	✓	✓	✓
H3a: Modeling → Comprehension	✓	n.s.	✓	n.s.
H3b: Modeling → Performance	✓	n.s.	✓	×
H4a: Self-efficacy → Performance O.E.	✓	✓	✓	×
H4b: Self-efficacy → Personal O.E.	✓	✓	✓	✓
H5a: Self-efficacy → Comprehension	n.s.	✓	✓	n.s.
H5b: Self-efficacy → Performance	✓	✓	✓	✓
H6a: Performance O.E. → Comprehension	✓	×	×	✓
H6b: Performance O.E. → Performance	n.s.	✓	×	×
H6c: Personal O.E. → Comprehension	n.s.	n.s.	×	×
H6d: Personal O.E. → Performance	×	×	×	✓
H7a: Prior Comprehension → Self-efficacy			✓	✓
H7b: Prior Performance → Self-efficacy			✓	×
H8a: Prior Comprehension → Performance O.E.			✓	n.s.
H8b: Prior Comprehension → Personal O.E.			✓	✓
H8c: Prior Performance → Performance O.E.			×	n.s.
H8d: Prior Performance → Personal O.E.			×	×
H9a: Prior Comprehension → Comprehension			n.s.	✓
H9b: Prior Comprehension → Performance			✓	✓
H9c: Prior Performance → Comprehension			✓	✓
H9d: Prior Performance → Performance			✓	✓
H10: Comprehension → Performance	✓	✓	✓	n.s.
H10: Prior Comp. → Prior Perf.			✓	✓

✓ means hypothesis supported at $p < 0.01$
× means path in opposite direction to prediction
n.s. means not significant

Table 43
Summary of Hypotheses (Path Co-efficients)

Hypothesis	Model 1 (Lotus 1)	Model 2 (WP 1)	Model 3 (Lotus 2)	Model 4 (WP 2)
H1: Modeling → Self-efficacy	-0.397*	0.018	-0.205*	0.185*
H2a: Modeling → Performance O.E.	0.225*	-0.194*	-0.175*	-0.182
H2b: Modeling → Personal O.E.	0.413*	-0.202*	-0.266*	-0.211*
H3a: Modeling → Comprehension	-0.244*	0.012	-0.158*	-0.009
H3b: Modeling → Performance	-0.092*	0.019	-0.190*	0.227*
H4a: Self-efficacy → Performance O.E.	0.567*	0.431*	0.433*	-0.009*
H4b: Self-efficacy → Personal O.E.	0.459*	0.143*	0.099*	0.138*
H5a: Self-efficacy → Comprehension	-0.055	0.653*	0.272*	0.028
H5b: Self-efficacy → Performance	0.124*	0.384*	0.112*	0.401*
H6a: Performance O.E. → Comprehension	0.315*	-0.136*	-0.107*	0.058*
H6b: Performance O.E. → Performance	-0.075	-0.040	-0.115*	-0.242*
H6c: Personal O.E. → Comprehension	0.063	0.064*	-0.271*	-0.138*
H6c: Personal O.E. → Performance	-0.186*	-0.166*	-0.136*	0.029*
H7a: Prior Comprehension → Self-efficacy			0.475*	0.181*
H7b: Prior Performance → Self-efficacy			0.186*	-0.024
H8a: Prior Comprehension → Performance O.E.			0.141*	-0.027*
H8b: Prior Comprehension → Personal O.E.			0.267*	0.161*
H8c: Prior Performance → Performance O.E.			-0.180*	-0.101
H8d: Prior Performance → Personal O.E.			-0.320*	-0.437*
H9a: Prior Comprehension → Comprehension			0.044	0.198*
H9b: Prior Comprehension → Performance			0.162*	0.418*
H9c: Prior Performance → Comprehension			0.434*	0.242*
H9d: Prior Performance → Performance			0.137*	0.066*
H10: Comprehension → Performance	0.628*	0.382*	0.428*	-0.009
H10: Prior Comp → Prior Performance			0.590*	0.622*

* $p < 0.01$

H3: Modeling → Comprehension/Hands-on performance. As was the case for the modeling to self-efficacy relationship, modeling had a significant positive impact on comprehension and hands-on performance for Lotus, but not for WordPerfect. A positive but not significant effect was found for WordPerfect training on day 1, while a negative effect was found for WordPerfect on day 2.

H4. Self-efficacy → Outcome Expectations. Overall, the results suggest that self-efficacy perceptions do indeed influence perceptions of both performance and personal outcomes. Three of the four models showed significant positive effects for performance outcome expectations and all four models showed significant positive effects for personal outcome expectations. A significant negative path was found between self-efficacy and performance outcome expectations, but the magnitude of the path was so small (β=-0.009) as to be inconsequential.

H5. Self-efficacy → Comprehension/Hands-on performance. The link between self-efficacy and comprehension scores was not clearly established in these data. Significant relationships were found in Models 2 and 3, but not in the others. Since these models are based on the same pool of subjects (those who learned WordPerfect on Day 1 and Lotus on Day 2) it may be that some systematic individual differences were at play. However, it was not possible to determine the source of the differences with the present data.

In terms of hands-on performance, the results clearly indicated that self-efficacy is an important precursor to performance. All four models indicated significant positive linkages between self-efficacy and performance.

H6. Outcome expectations → Comprehension/Hands-on performance. The predicted relationships between performance outcome expectations and both comprehension and performance were not supported by the data. For comprehension, two of the models resulted significant positive paths and two resulted in significant negative paths. For performance, two models produced non-significant paths and two produced significant negative paths.

Personal outcome expectations were not found to exert a positive influence on either comprehension or performance. For comprehension, two of the models had negative paths, one had a non-significant path, and one had a small ($\beta=0.064$) but significant path. For performance, three of the four models showed a negative relationship (the fourth was significant, but very small ($\beta=0.029$)).

H7. Prior comprehension/Hands-on performance → Self-efficacy. Comprehension of the software learned on day one significantly affected self-efficacy for the software learned on day two. This finding was especially true for the groups that learned Lotus second.

As was the case with comprehension, subjects' performance on day 1 positively influenced their self-efficacy for the package to be learned on day 2 for the group who learned WordPerfect first. However, performance did not significantly influence self-efficacy for the other group.

H8. Prior comprehension/Hands-on performance → Outcome expectations. A small but significant path was found between comprehension and performance outcome expectations for Model 3 and between comprehension and personal outcome expectations for both models. A small (β=-0.024) but significant negative effect was found for Model 4 (WordPerfect Day 2).

All of the paths from hands-on performance to performance or personal outcome expectations were opposite to that predicted. A larger negative path was found between hands-on performance and Personal Outcome Expectations, than between hands-on performance and Performance Outcome Expectations. This finding suggests that individuals' perceptions of the value of using computers for their jobs is less dependent on their performance and perhaps more dependent on the specific characteristics of their jobs. On the other hand, individuals' expectations of personal benefits are much more closely tied to their individual performance.

H9. Prior comprehension/Hands-on performance → Comprehension & Hands-on Performance. Positive paths were found for the prior comprehension to comprehension linkage in both models. However, only one of these was significant.

Positive significant paths were found for the prior comprehension to hands-on performance relationship in both models. Thus, individuals who scored higher on comprehension on day 1 scored higher on day 2. This linkage was stronger for subjects who learned Lotus first.

Significant positive paths were found between hands-on performance on day 1 software and comprehension of day 2 software for both models. Significant positive paths were also found between hands-on performance on day 1 software and hands-on performance on day 2 software, again for both models.

H10. Comprehension → Hands-on performance Overall the results suggest a positive relationship between comprehension and performance. Three of the four models resulted in strong significant paths. The fourth model (WordPerfect day 2) showed no relationship. In addition, both models 3 and 4 (Lotus day 2 and WordPerfect day 2) showed a strong positive path from prior comprehension to prior performance.

Variance Explained

Self-efficacy. The four models differed in their explanatory power with respect to self-efficacy scores (Table 44). Models 1 and 2 considered only the effect of behaviour modeling on self-efficacy. For model 1, 15.8% of the variance in self-efficacy scores was explained. For model 2, modeling did not significantly influence self-efficacy, and none of the variance in self-efficacy was explained (R^2 = 0%).

Models 3 and 4 incorporated the influence of prior experience on self-efficacy in addition to behaviour modeling, and resulted in much higher values for R^2 (38.8% for model 3 and 58% for model 4).

Table 44
Variance in Dependent Constructs
Explained by the Models

Construct	Model 1 (Lotus 1)	Model 2 (WP 1)	Model 3 (Lotus 2)	Model 4 (WP 2)
Self-efficacy	0.158	0.000	0.388	0.580
Performance Outcome Expectations	0.271	0.220	0.263	0.480
Personal Outcome Expectations	0.231	0.060	0.146	0.183
Comprehension	0.148	0.380	0.493	0.197
Performance	0.460	0.457	0.545	0.601
Prior Performance			0.349	0.387

Outcome Expectations. The proportion of variance explained differed across the four models, and between performance and personal outcome expectations. Overall, across the four models, more variance was explained in Performance Outcome Expectations than Personal Outcome Expectations.

Comprehension. Again, the explained variance differed across the models, ranging from $R^2=14.8\%$ for model 1 to $R^2=49.3\%$ for model 3. The explained variance was higher for the group that learned WordPerfect followed by Lotus than for the group that learned Lotus followed by WordPerfect.

Hands-on performance. The values for R^2 were high and consistent across the four models, though somewhat higher for day two, when prior performance is taken into account.

V. Discussion

Influence of Behaviour Modeling

Overall, the preceding analyses demonstrate that behaviour modeling can have an important influence on self-efficacy and outcome expectations, and that performance (both in terms of comprehension and hands-on performance) is influenced by self-efficacy. However, there are a number of interesting differences in the findings across the four research models, which suggests aspects of the modeling process that require further study.

First, modeling had a significant effect on self-efficacy for Lotus training only. Two possible explanations for this finding were considered. First, the differences in the modeling to self-efficacy relationship may be related to differences in the modeling tapes themselves. Different actors were used for the two tapes, and the tasks performed were different. While every attempt was made, in developing the tapes, to achieve similarity in the level of functioning for the different software packages, it was not always possible to translate concepts across the packages. Thus, differences in either the individual characteristics of the behaviour models or in their actual interaction with the software may have contributed to the inconsistencies in findings between Lotus and WordPerfect.

The second major explanation for the differences in results relates to the subjects' level of familiarity with the software packages. Subjects were generally more familiar with WordPerfect and the concepts of word processing than they were with Lotus and the concepts of spreadsheets. Gist and Mitchell (1992) suggest that there are differences in the formation of self-efficacy judgments for familiar and unfamiliar tasks. When subjects are very familiar with a particular behaviour, their judgments of self-efficacy are more automatic, and more directly determined by prior performance. When faced with unfamiliar tasks, subjects rely more on an in-depth assessment of what is required for performance and whether they have the appropriate skills (Gist & Mitchell, 1992, p.191). Gist and Mitchell's assertion suggests, effectively, that self-efficacy judgments are more malleable for unfamiliar tasks than for familiar behaviours. Thus, since Lotus was less familiar to the subjects than WordPerfect, subjects' Lotus self-efficacy could be influenced by modeling, while their WordPerfect self-efficacy could not.

Similarly, modeling had a positive direct influence on comprehension and hands-on performance for Lotus but not for WordPerfect. This finding is also consistent with the explanation that differences in the modeling videos (either attributable to the actors themselves or to the nature of the interaction demonstrated) resulted in different influences on outcome variables.

Impact of Self-efficacy

The hypotheses related to the impact of self-efficacy on both outcome expectations and performance were largely supported by the data. A stronger relationship was found between self-efficacy and performance for WordPerfect than for Lotus.

Again, this may relate to the issue of familiarity with the package. Self-efficacy judgments which are more fully formed based on prior experiences might logically be expected to exert a higher degree of influence on performance. However, additional research is needed to examine this possibility.

In addition, the relationship between self-efficacy and hands-on performance is stronger than that between self-efficacy and comprehension. The strength of this relationship, as compared to the self-efficacy → comprehension relationship, is consistent with Social Cognitive Theory. The comprehension test, as was noted earlier, was a measure of rote recall, concerned with whether subjects could remember what keys activated what functions, and how the features of the software operated. The hands-on test, on the other hand, required the subjects to apply their knowledge to novel situations. This type of task is more closely linked to the measure of self-efficacy, and thus ought to be more closely related.

Influence of Outcome Expectations

The findings with respect to outcome expectations were not consistent with the hypothesized relationships. Many of the relationships were small, indicating relatively little impact of outcome expectations on either comprehension and performance. More importantly, however, is the fact that many paths were negative, suggesting that individuals with higher outcome expectations exhibited lower performance.

One possible explanation for these unexpected results relates to the time horizon over which outcome expectations and performance were measured. That is, since outcome expectations focus more on long term effects, and since the performance measure considers only short term performance, it may be that the relationship has been artificially reduced (or negated). Consider an individual (Pat) who has never used computers before, but has a strong belief that using computers will be ultimately beneficial both from a professional and personal standpoint. Pat attends a training class, and by observing the instructor and others in the class, becomes even more convinced that using the computer will be beneficial (increase in outcome expectations). Pat is very motivated to do well on the performance test and to continue to use computers after the training. However, being very new to computers, Pat struggles greatly with the performance tasks at the end of the day, and is able to accomplish very little (low performance score), though as much as might be expected for a novice. This example shows how high outcome expectations (from a longer term perspective) might be accompanied by low performance (from a short term perspective). Since the average performance score is somewhat low (Table 25), it is not unreasonable to assume that this type of phenomena is partly influencing the results.

Impact of Prior Experience

The two models which included the influence of prior experience on self-efficacy, outcome expectations and performance provide substantial support for the stated hypotheses. As was the case with the influence of modeling, the relationship was stronger for Lotus than for WordPerfect. This finding is consistent with the explanation that self-efficacy judgments are formed more automatically for familiar packages, such as WordPerfect, on the basis of similar past experiences (e.g., perhaps using a typewriter). On the other hand, since using Lotus was a novel experience to the participants, they had to draw upon related experiences (such as using WordPerfect) or vicarious experiences (such as the modeling videotape) in order to develop a sense of their own ability.

In terms of outcome expectations, again, the relationships between prior performance and outcome expectations were unexpected. However, the notion that differences in the time horizon of measurement for performance and outcome expectations resulted in systematic differences in the variances of each construct seems plausible.

VI. Conclusions

Three general conclusions can be drawn from this study. First, self-efficacy does indeed influence computing performance. Individuals who see themselves as capable of using WordPerfect or Lotus 1-2-3 end up achieving higher performance than those who doubt their capabilities.

Second, modeling can be used successfully to alter self-efficacy and performance, but the effect of modeling is not entirely straightforward. The difference in the success of the two tapes may indicate one (or more) of three things. One possibility is that some software packages are more amenable to modeling (e.g., it is easier to model effective use of Lotus than WordPerfect). The features of the software itself and how it is used may in fact influence the degree to which behaviour modeling can be used. Alternatively, very specific aspects of the modeling (such as individual characteristics of the models, level of performance demonstrated or types of activities demonstrated) may influence the way in which the modeling was perceived. If this is so, then a great deal of attention to the way the modeling is conducted would be necessary in order to implement modeling in a practical sense. A third possibility is that the impact of modeling is moderated by the learners' familiarity with the particular software being modeled. When individuals are more familiar with the software (either in general or specific terms) their self-efficacy perceptions appear to be more resistant to change. Thus, the opportunity to influence their self-efficacy through modeling is not as strong as when individuals have little or no familiarity with the software.

Finally, when comparing outcome expectations and performance, the time horizon of measurement needs to be considered. In the present study, outcome expectations were not specifically measured in terms of short term outcomes, while the performance test reflected only short term performance attainments. Over time, outcome expectations and performance attainments might be expected to relate positively, but in the short term they do not appear to be related.

CHAPTER FIVE - CONCLUSIONS

I. Overview

Understanding individual reactions to computing technology has been a central concern of IS researchers and practitioners, since the achievement of organizational benefits through information technology depends, to a large extent, on the willingness and ability of individuals to use it productively. This research sought to further our understanding of individual reactions to computing technology through the application of a new theoretical perspective. IS research had largely overlooked the perspective of Social Cognitive Theory (Bandura, 1986), and the insights it offered into why and how well people use computers.

Of particular interest and importance to the research was the concept of self-efficacy. Social Cognitive Theory affords a central role to the process of self-referent thought. While other theories of behaviour that have been used in IS research (e.g., Expectancy Theory, the Theory of Reasoned Action) focus primarily on the expected outcomes of behaviour, Social Cognitive Theory holds that these expectations may have little effect on behaviour if individuals doubt their capabilities to successfully execute the required behaviour (i.e., they lack self-efficacy).

This chapter provides a brief recap of the research which was conducted. The contributions of this research to thought regarding individual reactions to computing technology are delineated, and the practical implications of the findings are discussed.

In addition, the limitations of each of the studies are considered. Lastly, the avenues for future research are highlighted.

II. Summary of Research

Two studies were undertaken to examine the Social Cognitive Theory perspective on individual reactions to computing technology. In the first study, a comprehensive model of individual reactions (Figure 13) was developed and tested through a survey of 1,000 Canadian managers and professionals. The model

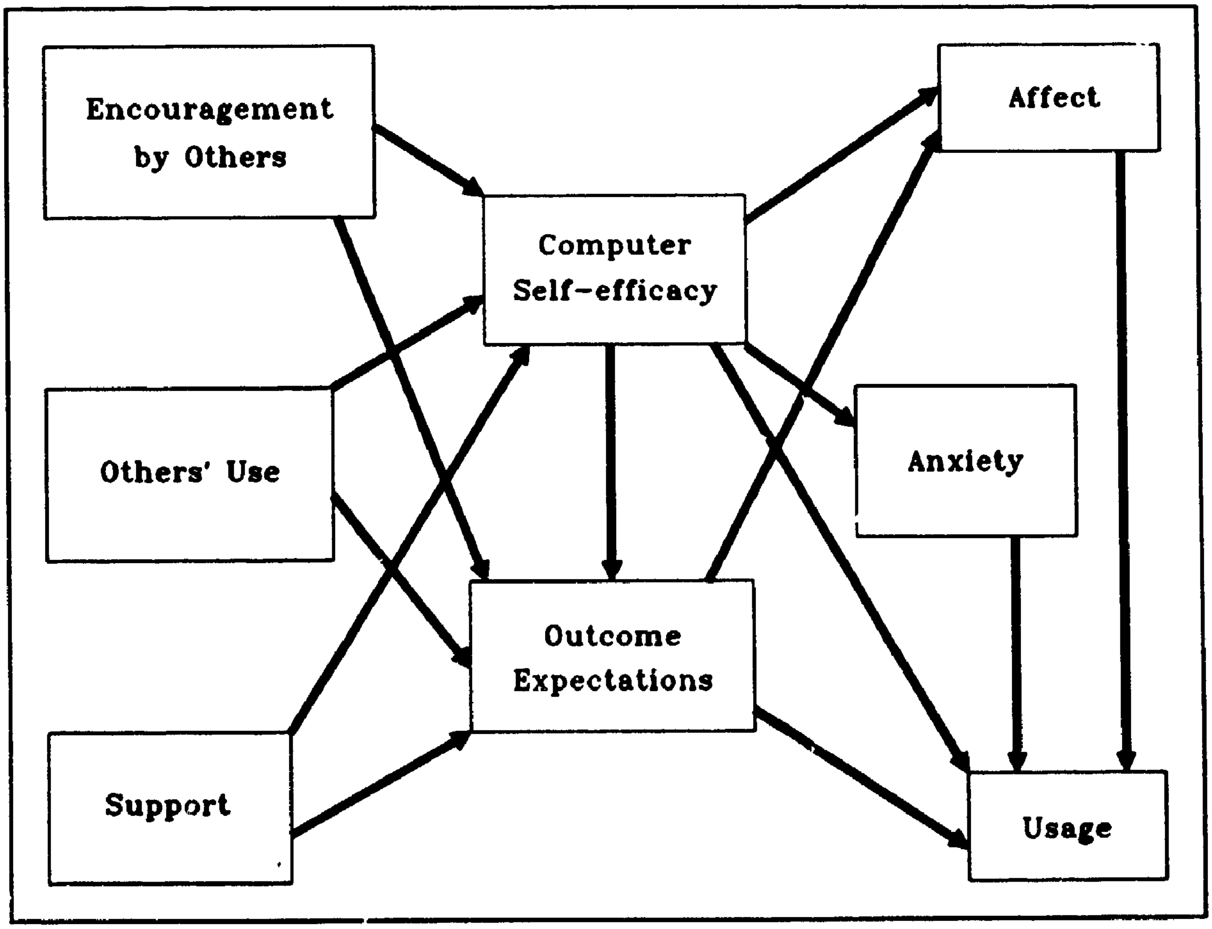


Figure 13. Study 1 Research Model

incorporated the key elements of Social Cognitive Theory (environmental influences, cognitive factors and behaviour). In addition, a longitudinal follow-up was conducted in order to examine whether the relationships held over time. This model was largely supported by the data.

The second study focused on the development of computing skills through training and the role of self-efficacy in this process. The formation of efficacy judgments through prior experience and behaviour modeling were also examined

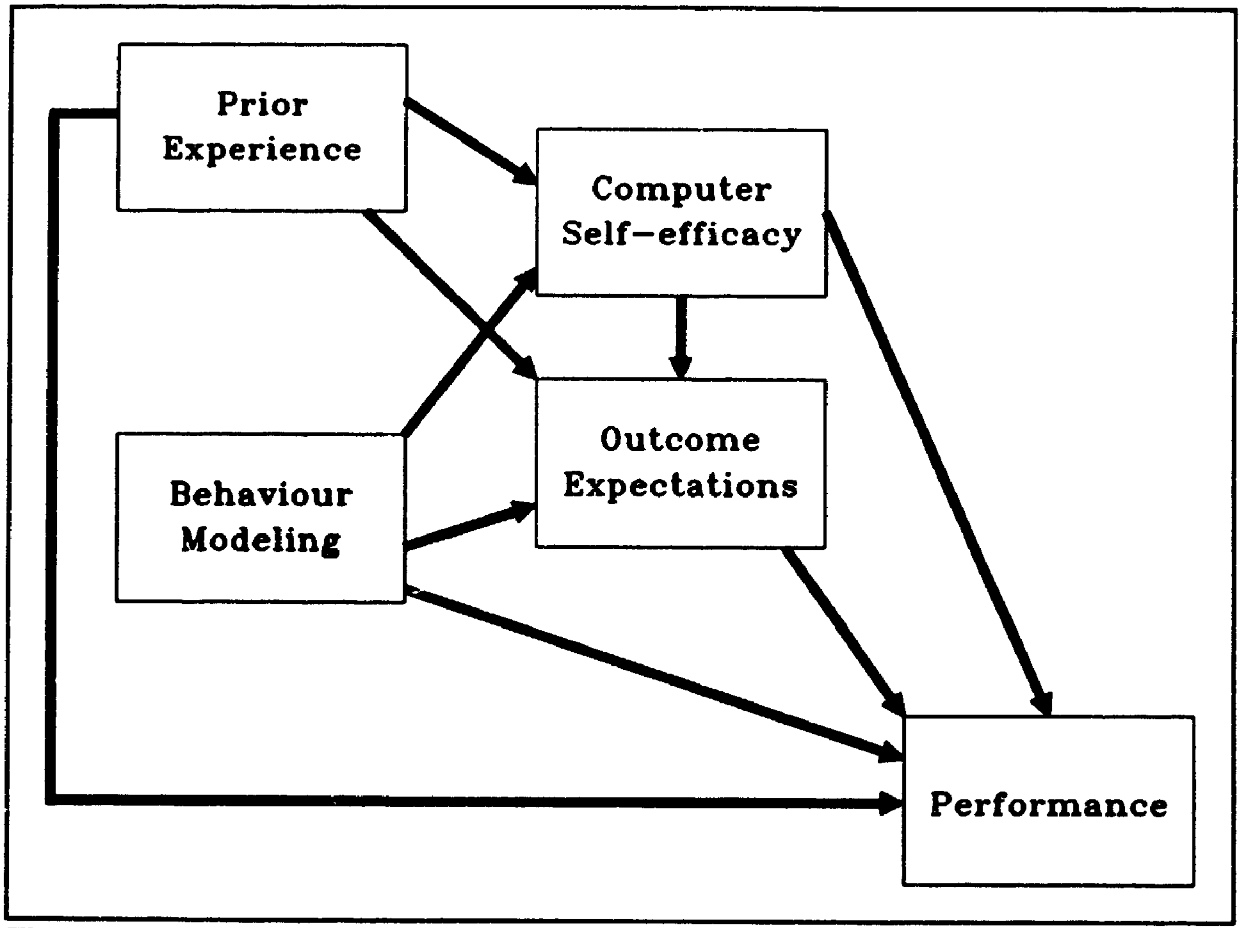


Figure 14. Study 2 Research Model

(Figure 14). In this study, eighty-eight managers and professionals were taught to use two popular software packages over the course of a two-day training program. Half of the participants observed a videotaped behaviour model as part of the training, and the other half received only the traditional lecture/demonstration. Thus, the influence of behaviour modeling, over and above the influence of training in general, was examined.

III. Findings and Contributions

The findings are discussed in terms of three basic categories. The first relates to the influence of outcome expectations. Information Systems research has considered concepts which are very similar to outcome expectations, such as attitude (Lucas, 1978; Robey, 1979; Schewe, 1976), usefulness (Davis, 1989; Davis et al., 1989), and perceived consequences (Thompson et al., 1991). Thus, these findings suggest areas where this research confirms the existing perspective on individual reactions to computing technology. The second set of findings to be discussed relate to the influence of self-efficacy. These findings highlight the contribution of Social Cognitive Theory to the formation of a more complete picture of individual reactions. The third, and final, set of findings relate to the formation of self-efficacy and outcome expectations. These findings are of particular importance to the development of strategies for changing behaviour through promotion of high self-efficacy and positive outcome expectations.

Influence of Outcome Expectations

The role of outcome expectations was studied in both the survey and the experiment. In the survey, individuals' perceptions of the performance-related and personal outcomes of using computers were found to influence both their liking for computers (affect) and their actual use of computers. Moreover, the relationships between performance outcome expectations and affect, and between performance outcome expectations and usage, held over time. That is, outcome expectations measured at one point in time were predictive of affect and usage one year later, providing strong evidence of a causal relationship. These results confirm the existing wisdom in IS research. Individuals who believe that using computers will result in positive benefits are more likely to engage in computer use than individuals who see the outcomes as either neutral or negative.

One surprising finding with respect to outcome expectations was the existence of a negative relationship between both performance-related and personal outcome expectations and the tests of comprehension and performance in the experiment, as well as between personal outcome expectations and usage in the longitudinal follow up to the survey. This finding suggests that computer skill (and also usage) may be negatively influenced by perceptions of positive outcomes. However, this notion runs contrary to both existing research and to Social Cognitive Theory. The reason for the negative relationship is not entirely clear, however, one explanation (discussed in Chapter 4) is that the time horizon over which outcome expectations are measured may influence the relationship with behavioural variables.

Alternatively, at least in the case of the survey, the negative relationships may reflect a reversed causal ordering. Social Cognitive Theory predicts reciprocal relationships among the variables. Outcome expectations are posited to influence behaviour, but one of the ways in which outcome expectations are formed is through actual experience. The relationships observed in these data may reflect this latter influence. For example, an individual who has little experience using computers (who would thus score low on a measure of usage) may have extremely high, possibly unreasonable, expectations about what computers can do (and would thus score high on a measure of outcome expectations) since they have not yet learned to see the limitations of computers. Individuals who use computers often, however, have a better sense of what computers can accomplish, and may thus have more moderate expectations regarding the outcomes of computer use. Clearly, additional research is needed to assess this finding.

Influence of Self-efficacy

The primary contribution of this research is the introduction of a previously overlooked, yet important, influence on behaviour. The results of both the survey and the experiment confirm the central role of self-efficacy in shaping individual reactions to computing technology.

Influence On Outcome Expectations

Self-efficacy was found to exert a strong influence on outcome expectations, both performance related outcome expectations as well as personal outcome expectations. Individuals who see themselves as capable of using computers are more likely to expect positive outcomes from their use of computers, whereas individuals who doubt their capabilities will not expect positive outcomes. Thus, regardless of the actual benefits of computer use, individuals may not form positive outcome expectations because they do not see themselves as being capable of using the technology.

Influence On Emotional Reactions

Self-efficacy was also found to influence the emotional reactions experienced by individuals with respect to computers. Individuals who view themselves as capable of using computers have higher affect (or liking) for computer use than those who view themselves as less capable of using computers. Moreover, computer anxiety was shown to be related to self-efficacy. Thus, individuals who lack self-efficacy experience anxiety in using computers, while those with high self-efficacy do not.

This finding has several important implications. First, it suggests that anxiety arises, at least in part, from a perceived lack of ability (or lack of self-efficacy). While some research has viewed anxiety in terms of fears of obsolescence or of being monitored by computers (i.e., big brother is watching), this research highlights the need to consider self-efficacy as an antecedent to anxiety. Moreover, while anxiety resulting from fears about the impact of computers may lessen, as users are educated about the benefits *and limitations* of the technology, anxiety resulting from low self-efficacy will not be so easily overcome.

Social Cognitive Theory argues that there is a reciprocal relationship between self-efficacy and anxiety. While this relationship was not explicitly tested in this research, it is important to understand the implications of this reciprocality in terms of changing self-efficacy. If individuals lack confidence in their ability to use computers, they are likely to experience anxiety as they engage in interactions with computers. This relationship was supported in the survey (Chapter 3, Hypothesis 9). But, the relationship does not end there. Bandura (1986) argues that physiological states (such as feelings of anxiety) are a source of efficacy information. In other words, an individual who experiences anxiety while using computers is likely to interpret these feelings as an indication of low ability, thus reinforcing the low sense of self-efficacy. As a result, low perceptions of self-efficacy are maintained through a vicious cycle of low self-efficacy → anxiety → low self-efficacy.

Influence On Behaviour

In addition to its influence on outcome expectations and emotional reactions, self-efficacy was found to have exert a direct influence on individual behaviour, both in terms of behaviour choice (whether and how much to use computers) and performance (how well the individual uses a specific software package). The implications of these findings are discussed in the following paragraphs.

First, individuals who lack computer self-efficacy will avoid the use of computers in their jobs. If possible, they will not use computers at all. At the very least, they will minimize their use of computers. Thus, regardless of the importance of computers to job performance, individuals will attempt to avoid them if they lack computer self-efficacy.

Second, the influence of self-efficacy is not limited to behaviour choice. Individuals who lack computer self-efficacy display lower performance in terms of software proficiency than individuals with high self-efficacy.

From a practical perspective, these findings suggest that, in order to convince people to use computers, it may be necessary to assist them in developing a positive perception of their ability to use them. Moreover, influencing self-efficacy is necessary, not only to encourage people to use computers, but also to improve the proficiency with which computers are used. The following section discusses the findings of this research which provide insights into how self-efficacy judgments can, in fact, be influenced.

Development of Self-efficacy and Outcome Expectations

In addition to demonstrating the important influence of self-efficacy and outcome expectations on individual reactions to computing technology, the findings of this research provide insights into how these judgments are formed, and how they can be changed.

Results from the Survey

Three aspects of the working environment which might be expected to influence self-efficacy and outcome expectations were examined in the survey: encouragement of use, others' use of computers, and organizational support.

Encouragement of use by others in the work environment represents social persuasion, one of the four sources information used in the formation of efficacy judgments (Bandura, 1986). Consistent with this view, it was found to have a positive influence on both self-efficacy and outcome expectations.

Others' use of computers was considered to reflect the role of vicarious experience in the formation of self-efficacy and outcome expectations. Again, this view was supported by the data. Individuals whose peers and superiors used computers had a higher sense of self-efficacy and more positive outcome expectations than those whose reference group did not use computers.

From a practical perspective, these two findings suggest ways in which managers can promote use of computers within an organization. Providing encouragement to those around us represents one way in which self-efficacy and outcome expectations can be raised. In addition, our own behaviour is an important source of information to those around us. Individuals who use computers act as behaviour models to those around them, and help them to develop high self-efficacy and outcome expectations. Thus, sharing our successes with computers, and explaining, or better still demonstrating, how computers have helped in various aspects of our work will help others see that (a) they are capable of using computers, and (b) that doing so will result in positive outcomes, both in terms of performance and from a personal standpoint.

The third environmental influence examined in the survey was organizational support, or the provision of assistance to users of computers. Surprisingly, support was negatively related to both self-efficacy and outcome expectations. Two possible reasons for these findings were discussed in Chapter Three. The first was that individuals with low self-efficacy might be more aware of the presence of high support. In other words, it may be that the causal influence works in an opposite direction to that hypothesized. Alternatively, it was suggested that the presence of high support might, in some ways, hinder the development of self-efficacy. If support involves helping users to solve their own problems and learn from them, then high self-efficacy is a logical result. If, on the other hand, support consists of a technical support person who either tells the user what keys to hit to fix the problem, or worse still, hits the keys for them, then low self-efficacy is the more likely result. Again, additional research is needed to better understand this finding.

Results from the Experiment

The experiment provides further insights into the development of self-efficacy and outcome expectations. The influence of training and in particular, behaviour modeling training, was investigated, as was the role of prior experience.

Training was found to be an important means of influencing both self-efficacy and outcome expectations. Self-efficacy, especially, was found to increase dramatically over the course of the training. Viewed from this perspective, then, one of the key objectives of formal training programs should be the promotion of high self-efficacy and outcome expectations.

The addition of behaviour modeling to the training was also found to have a positive influence for training in Lotus. Subjects who viewed a videotaped model demonstrating some of the typical problems encountered by novice users developed a stronger sense of their own capability, and ultimately demonstrated higher performance on a test of software proficiency. Thus, one way to design training programs to promote high self-efficacy is to incorporate learning by observation.

The fact that modeling only influenced self-efficacy for Lotus training suggests (as noted in Chapter Four) that characteristics of the modeling, or of the specific subject matter being taught, may moderate the relationship between modeling and self-efficacy. In particular, modeling seems to be most beneficial when individuals have little familiarity with the material to be learned. Thus, for simple concepts (e.g., word processing) the addition of behaviour modeling may have little effect on self-efficacy and learning, whereas, for more complicated computing concepts (e.g., spreadsheets, database), behaviour modeling can be expected to produce stronger results.

While the primary objective of the experiment was to examine the influence of training on self-efficacy, outcome expectations, and performance, the data also permitted examination of the role of prior experience in the formation of self-efficacy and outcome expectations. The findings confirm the Social Cognitive Theory perspective, that prior experience is one of the strongest sources of efficacy information. Moreover, they provide insights into the generalizability of self-efficacy across different software packages.

Subjects who did well on the first day of training, developed a high sense of their ability to use the other software package. Thus, successful experience with using computers is an important means of enhancing self-efficacy perceptions. Providing individuals with successful experiences, either through training programs or informal tutoring, provides an opportunity to help them develop confidence in their own abilities.

This finding was stronger for subjects who learned WordPerfect first. Thus, success (or failure) with WordPerfect is more likely to result in high (or low) self-efficacy for Lotus, than is success or failure with Lotus to result in high or low self-efficacy for WordPerfect. The difference in the strength of the relationship is not surprising. Lotus is conceptually less familiar for most novices (i.e., they don't have the analogy of a typewriter to compare with), so they must rely on their experiences with other computer packages to form judgments of their ability. WordPerfect, on the other hand, represents an extension of familiar concepts, so people can draw on other experiences in forming their self-efficacy judgments.

IV. Limitations

The Survey

The limitations of the survey, as is typical of studies of this kind, relate to the issue of internal validity. In the original model tested (with the results of the first survey), the primary limitation is the use of cross-sectional data. While the use of structural equations modeling in the data analysis minimizes the limitations with respect to making causal statements (by including all of the linkages in both the structural and measurement model), alternative formulations of the model (e.g., with use leading to self-efficacy) cannot be ruled out.

The addition of longitudinal data from the follow up survey helps to overcome this limitation with respect to some, but not all, of the hypothesized relationships. The hypothesized relationships between the cognitive factors (self-efficacy and outcome expectations), and the individual reactions (affect, anxiety and use) was supported with longitudinal data, but the relationships among the cognitive factors (from self-efficacy to outcome expectations) and among the reactions (from affect and anxiety to use) were not tested longitudinally. Thus, for these relationships the limitation of cross-sectional data still holds.

The Experiment

The limitations of the experiment relate to both internal and external validity. With respect to internal validity, two limitations should be noted. First, as discussed in Chapter Four, the differences in the influence of modeling for the two software packages may have been due to differences in the nature of the behaviour models. Different actors were used for the two software packages, and they may have differed in their influence, either in terms of their personal characteristics or in terms of their interaction with the software. The results of the study do not provide insights into the extent to which this may have occurred.

Second, the practice session, which was included in the sessions in order to maximize the realism of the training course, may have influenced the self-efficacy of the participants. Actual experience with a behaviour is one way in which self-efficacy judgments are formed. Thus, subjects' self-efficacy may have changed following the post measure but before the performance test. Since these possible changes were not measured, the relationship between self-efficacy immediately prior to performance and actual performance may be somewhat different than that shown by the data.

On the other hand, examination of the changes in self-efficacy scores through the course of the training, provides evidence against this possibility. Software specific self-efficacy scores were found to increase at each measurement until training in the software was received, but then to stay constant for the duration of the program. Thus, the self-efficacy possessed by an individual one day after training was the same as that possessed immediately after training but before the pretest. Since these measures are the same, it is unlikely that self-efficacy increased or decreased markedly at any points between the two measures.

With respect to external validity, the findings of the experiment are limited in terms of the characteristics of the sample. The subjects were primarily from small businesses (less than 200 employees), and may thus have distinguishing personal characteristics which would limit the ability to generalize to employees in larger firms. While this seems somewhat unlikely, it is possible that factors which encourage people to self-select into smaller organizations may be related to how they approach different aspects of their jobs (including the use of computers).

Of more importance than the organizational background of the subjects is their educational background. Most of the subjects had at least some college or university background, and a large percentage had a degree (or even a graduate degree). Thus, the findings are limited to individuals with similar backgrounds. Differences in educational background may indicate differences in approaches to learning or in ability to learn, and these differences may be have particular relevance for how training influences the development of computing skills.

V. Implications for Research

Social Cognitive Theory provides a promising foundation for future studies of individual reactions to computing technology. This research has shown the importance of considering both self-efficacy and outcome expectations as influences on individual reactions, and has specified the role of several environmental factors as influences on self-efficacy and outcome expectations. Future research, however, is needed to expand the investigation of Social Cognitive Theory into other areas of IS research. For example, what is the relationship between self-efficacy and perceived ease of use, discussed by Davis (1989). Theoretically, the concepts are very distinct. Self-efficacy measures an individual's perception of his or her ability, whereas perceived ease of use measures an individual's perception of the characteristics of a particular piece of software. Research is needed to demonstrate their empirical distinctiveness, and the relationship among them.

More broadly, there is a need to begin the process of linking the Social Cognitive Theory model tested in this research to the models which have been used in IS research to date (discussed in Chapter Two). In particular, there is a need to investigate the role of self-efficacy and outcome expectations within the context of models such as the Technology Assessment Model (Davis et al., 1989), Thompson et al.'s (1991) model of personal computer use, and Moore's (1989) model of personal workstation use.

It would also be interesting to investigate the relationships between computer self-efficacy and other individual variables, such as: self-esteem, locus of control, and overall self-confidence. Gist (1987) describes some of these relationships in terms of the general concept of self-efficacy, but there have been no attempts to test the relationships within the context of information technology utilization.

Additional research is also needed, to provide insights into the reciprocal linkages implicit in Social Cognitive Theory. Two of the findings of this study suggested that reciprocal causation may have been operating. In the case of the negative relationship between support and self-efficacy, it is possible that perceptions of self-efficacy lead to different perceptions of support. In the case of the negative outcome expectations → performance relationships, the same reversing of causality may explain the result. However, in both cases, alternative explanations for the unexpected findings also existed. Thus, additional investigation is necessary to help sort out the relationships.

Research is also needed to address issues in the formation of self-efficacy judgments. Bandura (1986) proposed four sources of information which may influence the development of self-efficacy: actual experience (enactive mastery), vicarious experience (modeling), verbal persuasion, and physiological states. Much of the research on self-efficacy, however, focuses on two specific influences on self-efficacy - behaviour modeling and enactive mastery. Thus, little research has attempted to examine the nature of these four sources of information and how they influence self-efficacy in a broader sense.

Within the context of computing behaviour, then, there exists an opportunity for research which (a) specifies the salient mastery, modeling, persuasory and physiological experiences which contribute to the formation of self-efficacy judgments and (b) explores how this information is used in developing a sense of self-efficacy.

In other words, how is information from each of these sources perceived, interpreted, and integrated into the formation of an overall judgment?

A related issue is how individuals' familiarity with a behaviour influences the formation of self-efficacy judgments. In the experiment, modeling was shown to have a stronger influence on the development of Lotus self-efficacy (a less familiar package) than on development of WordPerfect self-efficacy. This finding suggests that self-efficacy judgments may be formed through different processes, depending on the specific context. Additional research is needed, however, both to confirm that familiarity does play a role in forming efficacy judgments, and to understand the specific nature of this role.

VI. Conclusions

This research began from the perspective of addressing a specific management problem:

> **How can we understand individual reactions to computing technology and thus assist people in becoming more productive users of available technologies?**

The results of both studies support the validity of Social Cognitive Theory as a means of understanding and answering this question. In particular, the results underscore the need to consider the influence of self-efficacy, in addition to outcome expectations, on individual reactions to computing technology. Furthermore, the importance of reciprocal relationships among individual, environmental, and behavioural variables was suggested by some of the unexpected findings of the research. Further investigation of these relationships is proposed as a key area for future research. Lastly, the research demonstrates the influence of actual experience with the behaviour, vicarious experience (modeling), and social persuasion, on computer self-efficacy and outcome expectations.

APPENDIX A

PREVIOUS MEASURES OF COMPUTER SELF-EFFICACY

I. GIST ET AL. (1989) - COMPUTER SELF-EFFICACY

- 6 items, 6 levels of assistance for each task[5]
- Each item is prefaced by a description of what is involved in the skill described.

1. Learning to begin operating a microcomputer involves turning the machine on, inserting disks, and telling the computer to begin running a program.

I AM CAPABLE OF LEARNING TO OPERATE A MICROCOMPUTER:

	CAN DO (Y/N)	IF YES, CONFIDENCE (1 - 10) Not at all - Totally
When I am provided with written instructional material.	________	________
When the computer gives me instructions at each step, and informs me when I have completed a step successfully.	________	________
When I am able to listen to someone giving instructions who pauses as I complete each step.	________	________
When I am able to watch someone going through the steps before I try the procedures myself.	________	________
When there is an instructor to watch me as I complete each step, and give me feedback about the correctness of my actions.	________	________
When there is an instructor to guide me by telling me each step as I proceed, and explaining the steps and any errors I make.	________	________

2. I AM CAPABLE OF LEARNING TO USE A COMPUTER SOFTWARE PACKAGE.
3. I AM CAPABLE OF LEARNING THE STEPS AND COMMANDS NECESSARY TO CONSTRUCT FORMULAS ON WORKSHEETS/SPREADSHEETS.
4. I AM CAPABLE OF LEARNING ALL OF THE COMMANDS AND STEPS NECESSARY TO CREATE A SPREADSHEET FROM A MODEL.
5. I AM CAPABLE OF LEARNING TO PRINT COMPLETED SPREADSHEETS.
6. I AM CAPABLE OF LEARNING TO INDEPENDENTLY DEVELOP A LOTUS SPREADSHEET.

---

[5] The item description, levels of assistance and response scales are only shown for first question.

GIST ET AL. (1989) - SOFTWARE SELF-EFFICACY

- 10 items relating to use of specific software package
- no differences in levels of support assessed

I AM CAPABLE OF:	CAN DO (Y/N)	IF YES, CONFIDENCE (1 - 10) Not at all - Totally
1. Typing and entering numbers in cells.	_____	_____
2. Writing a formula for addition.	_____	_____
3. Entering a formula for addition in a cell.	_____	_____
4. Writing a formula for division.	_____	_____
5. Entering a formula for division in a cell.	_____	_____
6. Calling up the command to copy.	_____	_____
7. Telling the computer what to copy.	_____	_____
8. Telling the computer where to copy.	_____	_____
9. Writing new numbers which demonstrate the use of the formulas entered.	_____	_____
10. Viewing the formulas to be sure they are correct.	_____	_____

II. WEBSTER & MARTOCCHIO (1990)

- 5 items, 7 point response scale (strongly disagree - strongly agree)

1. I feel confident that I can use the WordPerfect merging feature.
2. Using WordPerfect's merging feature is probably something I will be good at.
3. It just will not be possible for me to use the WordPerfect merging feature as well as I would like.
4. I believe that the WordPerfect merging feature is a skill that I can use easily.
5. I believe that my Wordperfect merging skills will improve substantially through this training on Wordperfect.

III. HILL ET AL. (1987)

- 4 items, 5 point response scale (totally agree - totally disagree)

1. I will never understand how to use a computer.
2. Only a few experts really understand how computers work.
3. It is extremely difficult to learn a computer language.
4. Computer errors are very difficult to fix.

APPENDIX B

COMPUTER SELF-EFFICACY MEASURE USED IN SURVEY

Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident."

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		Not at All Confident				Moderately Confident				Totally Confident
...if there was someone giving me step by step instructions.	[✓ YES]	1	2	3	4	[✓ 5]	6	7	8 9	10
	NO									

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so.

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

			Not at All Confident				Moderately Confident				Totally Confident
Q-1.	if there was no one around to tell me what to do as I go.	YES	1	2	3	4	5	6	7	8 9	10
		NO									
Q-2.	if I had never used a package like it before.	YES	1	2	3	4	5	6	7	8 9	10
		NO									

			Not at All Confident				Moderately Confident					Totally Confident
Q-3.	if I had only the software manuals for reference.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-4.	if I had seen someone else using it before trying it myself.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-5.	if I could call someone for help if I got stuck.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-6.	if someone else had helped me get started.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-7.	if I had a lot of time to complete the job for which the software was provided.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-8.	if I had just the built-in help facility for assistance.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-9.	if someone showed me how to do it first.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-10.	if I had used similar packages before this one to do the same job.	YES	1	2	3	4	5	6	7	8	9	10
		NO										

APPENDIX C

COMPUTER ATTITUDES SURVEY

SECTION A

This part of the questionnaire asks about your use of computers at work and at home. For each question, please circle the response that best describes *your* use of computers.

Q-1. How much experience do you have with computers? (Circle number)

1 NONE
2 A LITTLE BIT
3 SOME
4 A FAIR BIT
5 A LOT

Q-2. For each of the following types of computer systems, please indicate how familiar you are with using it. (Circle number)

	Not at All Familiar		Somewhat Familiar		Very Familiar
1 APPLE PERSONAL COMPUTERS	1	2	3	4	5
2 IBM PCs (OR CLONES)	1	2	3	4	5
3 MINICOMPUTERS	1	2	3	4	5
4 MAINFRAME COMPUTERS	1	2	3	4	5

Q-3. For each of the following types of software, please indicate how familiar you are with using it. (Circle number)

	Not at All Familiar		Somewhat Familiar		Very Familiar
1 SPREADSHEETS	1	2	3	4	5
2 WORD PROCESSORS	1	2	3	4	5
3 DATA BASE PACKAGES	1	2	3	4	5
4 STATISTICAL PACKAGES	1	2	3	4	5
5 GRAPHICS PROGRAMS	1	2	3	4	5
6 ELECTRONIC MAIL	1	2	3	4	5
7 PROGRAMMING LANGUAGES	1	2	3	4	5

Q-4. On average, approximately how much time do you spend each day using a computer at your place of work?

_____ HOURS and _____ MINUTES

Q-5. On your last working day (not Saturday or Sunday) how much time did you spend using a computer at your place of work?

_____ HOURS and _____ MINUTES

Q-6. On average, how frequently do you use a computer at work? (Circle number)

1 SEVERAL TIMES A DAY
2 ABOUT ONCE A DAY
3 A FEW TIMES A WEEK
4 A FEW TIMES A MONTH
5 ONCE A MONTH
6 LESS THAN ONCE A MONTH

Q-7. Do you have a computer at home? (Circle number)

1 YES
2 NO →

If you do not have a computer at home please go to Q-11 on page 3.

Q-8. On average, approximately how much time do you spend each day using your home computer?

WEEKDAYS:

_____ HOURS and _____ MINUTES

WEEKENDS:

_____ HOURS and _____ MINUTES

Q-9. On your last working day (not Saturday or Sunday) how much time did you spend using your home computer?

_____ HOURS and _____ MINUTES

Q-10. How much time did you spend using your home computer last weekend?

_____ HOURS and _____ MINUTES

The next two questions ask about the kinds of computer training you may have received.

Q-11. For each of the following sources of training, please indicate how much computer training you have received from that source. (Circle number)

	None	Slight	Moderate	Substantial
1 COLLEGE OR UNIVERSITY	1	2	3	4
2 HARDWARE OR SOFTWARE VENDOR	1	2	3	4
3 CONSULTANT	1	2	3	4
4 COMPANY TRAINING PROGRAM	1	2	3	4
5 SELF-TRAINING (eg. tutorials)	1	2	3	4

Q-12. For each of the training sources from which you have received computer training, please indicate the quality of the training provided. (Circle number)

	Poor	Fair	OK	Good	Excellent
1 COLLEGE OR UNIVERSITY	1	2	3	4	5
2 HARDWARE OR SOFTWARE VENDOR	1	2	3	4	5
3 CONSULTANT	1	2	3	4	5
4 COMPANY TRAINING PROGRAM	1	2	3	4	5
5 SELF-TRAINING (eg. tutorials)	1	2	3	4	5

SECTION B

The following statements describe the outcomes that people might experience as a result of using a computer. For each item indicate *on the first scale* whether you feel you would be likely to experience that outcome from your computer use. Then, *on the second scale,* indicate how important that outcome is to you.

Consider the following sample item.

IF I USE A COMPUTER...

	LIKELIHOOD OF OUTCOME					IMPORTANCE OF OUTCOME				
	Very Unlikely		Neutral		Very Likely	Not at all important		Somewhat important		Very important
... I will be more productive	1	2	3	4	[✓ 5]	1	2	[✓ 3]	4	5

The responses to the sample item indicate that the individual felt that using a computer would be very likely to increase his or her productivity, and that productivity is a somewhat important outcome for that individual.

Please answer both parts to every question. Circle the number on each scale that indicates how you feel.

IF I USE A COMPUTER...

	LIKELIHOOD OF OUTCOME					IMPORTANCE OF OUTCOME				
	Very Unlikely		Neutral		Very Likely	Not at all important		Somewhat important		Very important
Q-13. ...I will be better organized	1	2	3	4	5	1	2	3	4	5
Q-14. ...my co-workers will perceive me as competent	1	2	3	4	5	1	2	3	4	5
Q-15. ...I will increase my sense of accomplishment	1	2	3	4	5	1	2	3	4	5
Q-16. ...I will increase my chances of obtaining a promotion	1	2	3	4	5	1	2	3	4	5

Q-17.	...I will increase my effectiveness on the job	1	2	3	4	5	1	2	3	4	5
Q-18.	...I will be seen as higher in status by my peers	1	2	3	4	5	1	2	3	4	5
Q-19.	...I will increase my chances of getting a raise	1	2	3	4	5	1	2	3	4	5
Q-20.	...I will spend less time on routine job tasks	1	2	3	4	5	1	2	3	4	5
Q-21.	...I will increase the quality of output of my job	1	2	3	4	5	1	2	3	4	5
Q-22.	...I will increase the quantity of output for the same amount of effort	1	2	3	4	5	1	2	3	4	5
Q-23.	...I will be less reliant on clerical support staff	1	2	3	4	5	1	2	3	4	5

The next few statements describe feelings that some people have about computers. For each statement, please indicate the extent to which you agree or disagree with the feelings being expressed.

Please circle your response.

		Strongly Disagree		Neither Agree nor Disagree		Strongly Agree
Q-24.	I like working with computers	1	2	3	4	5
Q-25.	I look forward to those aspects of my job that require me to use a computer	1	2	3	4	5
Q-26.	Once I start working on the computer, I find it hard to stop	1	2	3	4	5
Q-27.	Using a computer is frustrating for me	1	2	3	4	5
Q-28.	I get bored quickly when working on a computer	1	2	3	4	5

SECTION C

This part of the questionnaire asks you about your ability to use an *unfamiliar* piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		Not at All Confident				Moderately Confident					Totally Confident
...if there was someone giving me step by step instructions.	[✓ YES]	1	2	3	4	[✓ 5]	6	7	8	9	10
	NO										

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so.

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

			Not at All Confident				Moderately Confident					Totally Confident
Q-29.	...if there was no one around to tell me what to do as I go.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-30.	...if I had never used a package like it before.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-31.	...if I had only the software manuals for reference.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-32.	...if I had seen someone else using it before trying it myself.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-33.	...if I could call someone for help if I got stuck.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-34.	...if someone else had helped me get started.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-35.	...if I had a lot of time to complete the job for which the software was provided.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-36.	...if I had just the built-in help facility for assistance.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-37.	...if someone showed me how to do it first.	YES	1	2	3	4	5	6	7	8	9	10
		NO										
Q-38.	...if I had used similar packages before this one to do the same job.	YES	1	2	3	4	5	6	7	8	9	10
		NO										

SECTION D

This section of the questionnaire asks about your feelings towards using computers. The following statements reflect various feelings towards using computers that you may or may not hold. For each statement, please indicate the extent to which you agree or disagree with the feelings expressed.

Please circle your response.

		Strongly Disagree		Neither Agree nor Disagree		Strongly Agree
Q-39.	I feel insecure about my ability to interpret a computer printout	1	2	3	4	5
Q-40.	I look forward to using a computer on my job	1	2	3	4	5
Q-41.	I do not think I would be able to learn a computer programming language	1	2	3	4	5
Q-42.	The challenge of learning about computers is exciting	1	2	3	4	5
Q-43.	I am confident that I can learn computer skills	1	2	3	4	5
Q-44.	Anyone can learn to use a computer if they are patient enough	1	2	3	4	5
Q-45.	Learning to operate computers is like learning any new skill - the more you practice, the better you become	1	2	3	4	5
Q-46.	I am afraid that if I use computers I will become dependent on them and lose some of my reasoning skills	1	2	3	4	5
Q-47.	I feel computers are necessary tools in educational settings	1	2	3	4	5
Q-48.	I feel that I will be able to keep up with the advances happening in the computer field	1	2	3	4	5
Q-49.	I dislike working with machines that are smarter than I am	1	2	3	4	5

		Strongly Disagree		Neither Agree nor Disagree		Strongly Agree
Q-50.	I feel apprehensive about using computers	1	2	3	4	5
Q-51.	I have difficulty in understanding the technical aspects of computers	1	2	3	4	5
Q-52.	It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key	1	2	3	4	5
Q-53.	I hesitate to use a computer for fear of making mistakes that I cannot correct	1	2	3	4	5
Q-54.	You have to be a genius to understand all the special keys contained on most computer terminals	1	2	3	4	5
Q-55.	If given the opportunity, I would like to learn more about computers	1	2	3	4	5
Q-56.	Computers are somewhat intimidating to me	1	2	3	4	5
Q-57.	I feel computers are necessary tools in work settings	1	2	3	4	5

SECTION E

This section of the questionnaire asks about the computer use and attitudes of other people that you know, and about the support provided for computing in your organization.

Q-58. To what extent do you feel that using a computer is encouraged or discouraged by each of the following groups of people? (Circle number)

	Use is Strongly Discouraged		Use is Neither Encouraged nor Discouraged		Use is Strongly Encouraged	
YOUR PEERS IN YOUR ORGANIZATION	1	2	3	4	5	N/A
YOUR PEERS IN OTHER ORGANIZATIONS	1	2	3	4	5	N/A
YOUR FAMILY	1	2	3	4	5	N/A
YOUR FRIENDS	1	2	3	4	5	N/A
YOUR MANAGER	1	2	3	4	5	N/A
OTHER MANAGEMENT	1	2	3	4	5	N/A
YOUR SUBORDINATES	1	2	3	4	5	N/A

Q-59. To what extent do each of the following groups of people use computers? (Circle number)

	To a Very Little Extent		To Some Extent		To a Very Great Extent	
YOUR PEERS IN YOUR ORGANIZATION	1	2	3	4	5	N/A
YOUR PEERS IN OTHER ORGANIZATIONS	1	2	3	4	5	N/A
YOUR FAMILY	1	2	3	4	5	N/A
YOUR FRIENDS	1	2	3	4	5	N/A
YOUR MANAGER	1	2	3	4	5	N/A
OTHER MANAGEMENT	1	2	3	4	5	N/A
YOUR SUBORDINATES	1	2	3	4	5	N/A

The next few questions concern the amount of support your organization provides for computer users. Please indicate the extent to which you agree or disagree with each of the following statements.

		Strongly Disagree		Neither Agree nor Disagree		Strongly Agree
Q-60.	Guidance is available to me in the selection of hardware, software, printers, and other equipment	1	2	3	4	5
Q-61.	A specific person (or group) is available for assistance with software difficulties	1	2	3	4	5
Q-62.	A specific person (or group) is available for assistance with hardware difficulties	1	2	3	4	5
Q-63.	Specialized instruction and education concerning popular software are available to me	1	2	3	4	5
Q-64.	My co-workers are able to provide assistance when I encounter problems using the computer	1	2	3	4	5
Q-65.	In general, I feel this organization has been very supportive of computer users	1	2	3	4	5

SECTION F

The remainder of the questionnaire asks for some information about yourself. This information is important to allow us to study the effects of differences between people on their feelings about computers.

Q-66. Please describe the organization in which you work.

NAME OF ORGANIZATION ______________________________

INDUSTRY ______________________________________

NUMBER OF EMPLOYEES_______________________________

DEPARTMENT ____________________________________

NUMBER OF EMPLOYEES IN DEPARTMENT __________________

Q-67. How long have you worked for this organization?

______ YEARS and ______ MONTHS

Q-68. What is your functional area? (Circle number)

1 ACCOUNTING
2 ENGINEERING, DESIGN, R&D
3 FINANCE
4 GENERAL MANAGEMENT
5 PRODUCTION
6 MARKETING OR SALES
7 INFORMATION SYSTEMS
8 HUMAN RESOURCES
9 OTHER
Please specify __________________________

Q-69. What is the level of your position? (Circle number)

1 EXECUTIVE
2 MIDDLE MANAGEMENT
3 FIRST LINE MANAGEMENT
4 PROFESSIONAL
5 TECHNICAL
6 CLERICAL OR SECRETARIAL

7 OTHER
Please specify ____________________________

Q-70. Do you consider your position to be a line or a staff position? (Circle number)

1 LINE
2 STAFF

Q-71. How many people report directly to you?

________ PEOPLE

Q-72. What is your age?

________ YEARS

Q-73. What is your sex? (Circle number)

1 FEMALE
2 MALE

Q-74. Which is the highest level of education that you have completed? (Circle the last category that applies)

1 SOME VOCATIONAL OR HIGH SCHOOL
2 COMPLETED VOCATIONAL OR HIGH SCHOOL
3 SOME COLLEGE OR UNIVERSITY
4 COMPLETED COLLEGE OR UNIVERSITY
5 SOME GRADUATE WORK
6 A GRADUATE DEGREE

Q-75. What is your primary educational background? (Circle number)

1 BUSINESS
2 ARTS
3 SCIENCE
4 SOCIAL SCIENCE
5 OTHER
Please specify ____________________________

Q-76. What is your annual salary? (Circle number)

1 LESS THAN $30,000
2 $30,000 TO $59,999
3 $60,000 TO $89,999
4 $90,000 TO $119,999
5 $120,000 TO $149,999
6 $150,000 OR MORE

Thank you very much for your assistance!!

Please return your questionnaire in the envelope provided to:

Debbie Compeau
Project Co-ordinator,
Computer Attitudes Survey
School of Business Administration
The University of Western Ontario
London, Ontario
N6A 3K7

If you have any questions, or would like to discuss the survey further, please call me collect (519) 679-2111 ext. 5129

APPENDIX D

FOLLOW UP LETTER

(sent to non-respondents after 3 weeks)

[UNIVERSITY OF WESTERN ONTARIO LETTERHEAD]

[DATE]

[INSIDE ADDRESS]

Dear Sir/Madam,

Three weeks ago a questionnaire was mailed to you concerning your feelings about and use of computers.

If you have already completed and returned it to us, please accept our sincere thanks. If not, please do so today. Because the survey was sent to only a small, but representative, sample of professionals, it is extremely important that your responses be included in the study.

If by some chance you did not receive the questionnaire, or it got misplaced, please call me (661-3206 ext. 5129) and I will get another one in the mail to you today.

Sincerely,

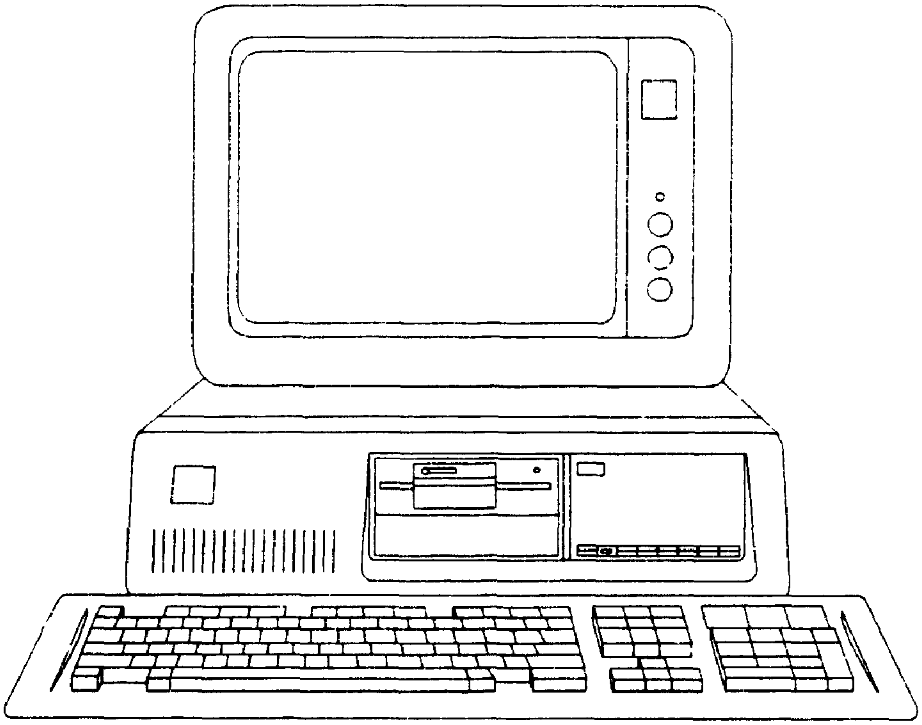
Debbie Compeau
Project Co-ordinator

APPENDIX E

COMPUTER ATTITUDES SURVEY

(Follow Up Questionnaire)

COMPUTER ATTITUDES SURVEY
FOLLOW UP QUESTIONNAIRE



School of Business Administration
The University of Western Ontario
and
School of Business Administration
Carleton University

SECTION A

This part of the questionnaire asks about your use of computers at work and at home. For each question, please circle the response that best describes *your* use of computers.

Q-1. How much experience do you have with computers? (Circle number)

1 NONE
2 A LITTLE BIT
3 SOME
4 A FAIR BIT
5 A LOT

Q-2. For each of the following types of computer systems, please indicate how familiar you are with using it. (Circle number)

	Not at All Familiar		Somewhat Familiar		Very Familiar
1 APPLE PERSONAL COMPUTERS	1	2	3	4	5
2 IBM PCs (OR CLONES)	1	2	3	4	5
3 MINICOMPUTERS	1	2	3	4	5
4 MAINFRAME COMPUTERS	1	2	3	4	5

Q-3. For each of the following types of software, please indicate how familiar you are with using it. (Circle number)

	Not at All Familiar		Somewhat Familiar		Very Familiar
1 SPREADSHEETS	1	2	3	4	5
2 WORD PROCESSORS	1	2	3	4	5
3 DATA BASE PACKAGES	1	2	3	4	5
4 STATISTICAL PACKAGES	1	2	3	4	5
5 GRAPHICS PROGRAMS	1	2	3	4	5
6 ELECTRONIC MAIL	1	2	3	4	5
7 PROGRAMMING LANGUAGES	1	2	3	4	5

Q-4. Compared to last year, does your job now require you to use a computer more, less or the same? (Circle number)

1 MUCH LESS THAN LAST YEAR
2 SOMEWHAT LESS THAN LAST YEAR
3 ABOUT THE SAME AS LAST YEAR
4 SOMEWHAT MORE THAN LAST YEAR
5 MUCH MORE THAN LAST YEAR

Q-5. On average, how frequently do you use a computer at your place of work? (Circle number)

1 SEVERAL TIMES A DAY
2 ABOUT ONCE A DAY
3 A FEW TIMES A WEEK
4 A FEW TIMES A MONTH
5 ONCE A MONTH
6 LESS THAN ONCE A MONTH

Q-6. On an *average working day* that you use a computer at your place of work, how much time do you spend at the computer?

_____ HOURS and _____ MINUTES

Q-7. Do you have a computer at home? (Circle number)

1 YES
2 NO →

If you do not have a computer at home please go to Q-10 on page 3.

Q-8. On average, how frequently do you use your home computer? (Circle number)

1 EVERY DAY
2 A FEW TIMES A WEEK
3 ONCE A WEEK
4 A FEW TIMES A MONTH
5 ONCE A MONTH
6 LESS THAN ONCE A MONTH

Q-9. On an average day that you use your home computer, how much time do you spend at the computer?

WEEKDAYS: _____ HOURS and _____ MINUTES

WEEKENDS: _____ HOURS and _____ MINUTES

Q-10. For each of the following sources of training, please indicate how much computer training you have received IN THE LAST TWELVE MONTHS from that source. (Circle number)

	None	Slight	Moderate	Substantial
1 COLLEGE OR UNIVERSITY	1	2	3	4
2 HARDWARE OR SOFTWARE VENDOR	1	2	3	4
3 CONSULTANT	1	2	3	4
4 COMPANY TRAINING PROGRAM	1	2	3	4
5 SELF-TRAINING (eg., tutorials)	1	2	3	4
6 OTHER (e.g., a friend)	1	2	3	4

Q-11. For each of the training sources from which you have received computer training, IN THE LAST TWELVE MONTHS, please indicate the quality of the training provided. (Circle number)

	Poor	Fair	OK	Good	Excellent	
1 COLLEGE OR UNIVERSITY	1	2	3	4	5	N/A
2 HARDWARE OR SOFTWARE VENDOR	1	2	3	4	5	N/A
3 CONSULTANT	1	2	3	4	5	N/A
4 COMPANY TRAINING PROGRAM	1	2	3	4	5	N/A
5 SELF-TRAINING (eg. tutorials)	1	2	3	4	5	N/A
6 OTHER (e.g., a friend)	1	2	3	4	5	N/A

SECTION B

This part of the questionnaire asks you about your ability to use an *unfamiliar* piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		Not at All Confident				Moderately Confident					Totally Confident
...if there was someone giving me step by step instructions.	[✓ YES] NO	 1	2	3	4	[✓ 5]	6	7	8	9	10

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so (5 is circled).

If, on the other hand, the individual *did not* think he or she could complete the job using the software with step by step instructions, he or she would have circled NO, and gone on to the next question.

Q-12. I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		Not at All Confident				Moderately Confident					Totally Confident
...if there was no one around to tell me what to do as I go.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I had never used a package like it before.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I had only the software manuals for reference.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I had seen someone else using it before trying it myself.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I could call someone for help if I got stuck.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if someone else had helped me get started.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I had a lot of time to complete the job for which the software was provided.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I had just the built-in help facility for assistance.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if someone showed me how to do it first.	YES .... NO	1	2	3	4	5	6	7	8	9	10
...if I had used similar packages before this one to do the same job.	YES .... NO	1	2	3	4	5	6	7	8	9	10

SECTION C

This part of the questionnaire asks about your feelings towards computers. The first question asks about how you feel when using a computer. For each adjective listed, please indicate whether or not this feeling is characteristic of you when you use a computer. Work quickly through the list. (Circle number)

Q-13. WHEN I USE A COMPUTER, I FEEL...

	Strongly Disagree		Neutral		Strongly Agree
...ACTIVE	1	2	3	4	5
...ADVENTUROUS	1	2	3	4	5
...AFRAID	1	2	3	4	5
...ALIVE	1	2	3	4	5
...ANXIOUS	1	2	3	4	5
...AWED	1	2	3	4	5
...BEWILDERED	1	2	3	4	5
...CAUTIOUS	1	2	3	4	5
...CHALLENGED	1	2	3	4	5
...CONFUSED	1	2	3	4	5
...CURIOUS	1	2	3	4	5
...DARING	1	2	3	4	5
...DESPERATE	1	2	3	4	5
...DISCOURAGED	1	2	3	4	5
...ENTHUSIASTIC	1	2	3	4	5
...FEARFUL	1	2	3	4	5
...FRIGHTENED	1	2	3	4	5
...HOPEFUL	1	2	3	4	5
...IGNORANT	1	2	3	4	5
...INTERESTED	1	2	3	4	5
...LOST	1	2	3	4	5

WHEN I USE A COMPUTER, I FEEL...

	Strongly Disagree		Neutral		Strongly Agree
...NERVOUS	1	2	3	4	5
...PANICKY	1	2	3	4	5
...PLEASED	1	2	3	4	5
...POWERFUL	1	2	3	4	5
...SHAKY	1	2	3	4	5
...STIMULATED	1	2	3	4	5
...TENSE	1	2	3	4	5
...THREATENED	1	2	3	4	5
...UNCOMFORTABLE	1	2	3	4	5
...UPSET	1	2	3	4	5
...WORRYING	1	2	3	4	5

The next few statements describe feelings that some people have about computers. For each statement, please indicate the extent to which you agree or disagree with the feelings being expressed.

Please circle your response.

	Strongly Disagree		Neutral		Strongly Agree
Q-14. I like working with computers	1	2	3	4	5
Q-15. I look forward to those aspects of my job that require me to use a computer	1	2	3	4	5
Q-16. Once I start working on the computer, I find it hard to stop	1	2	3	4	5
Q-17. Using a computer is frustrating for me	1	2	3	4	5
Q-18. I get bored quickly when working on a computer	1	2	3	4	5
Q-19. I feel apprehensive about using computers	1	2	3	4	5

	Strongly Disagree		Neutral		Strongly Agree
Q-20. It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key	1	2	3	4	5
Q-21. I hesitate to use a computer for fear of making mistakes that I cannot correct	1	2	3	4	5
Q-22. Computers are somewhat intimidating to me	1	2	3	4	5

The next question describes the outcomes that people might experience as a result of using a computer. For each item, please indicate whether you feel you would be likely to experience that outcome from your computer use. (Circle number)

Q-23. IF I USE A COMPUTER...

	Very Unlikely		Neutral		Very Likely
...I will be better organized	1	2	3	4	5
...my co-workers will perceive me as competent	1	2	3	4	5
...I will increase my sense of accomplishment	1	2	3	4	5
...I will increase my chances of obtaining a promotion	1	2	3	4	5
...I will increase my effectiveness on the job	1	2	3	4	5
...I will be seen as higher in status by my peers	1	2	3	4	5
...I will increase my chances of getting a raise	1	2	3	4	5
...I will spend less time on routine job tasks	1	2	3	4	5
...I will increase the quality of output of my job	1	2	3	4	5
...I will increase the quantity of output for the same amount of effort	1	2	3	4	5
...I will be less reliant on clerical support staff	1	2	3	4	5

SECTION D

This section of the questionnaire asks about the computer use and attitudes of other people that you know, and about the support provided for computing in your organization.

Q-24. To what extent do you feel that using a computer is encouraged or discouraged by each of the following groups of people? (Circle number)

	Use is Strongly Discouraged		Use is Neither Encouraged nor Discouraged		Use is Strongly Encouraged	
YOUR PEERS IN YOUR ORGANIZATION	1	2	3	4	5	N/A
YOUR PEERS IN OTHER ORGANIZATIONS	1	2	3	4	5	N/A
YOUR MANAGER	1	2	3	4	5	N/A
OTHER MANAGEMENT	1	2	3	4	5	N/A
YOUR SUBORDINATES	1	2	3	4	5	N/A

Q-25. To what extent do each of the following groups of people use computers? (Circle number)

	To a Very Little Extent		To Some Extent		To a Very Great Extent	
YOUR PEERS IN YOUR ORGANIZATION	1	2	3	4	5	N/A
YOUR PEERS IN OTHER ORGANIZATIONS	1	2	3	4	5	N/A
YOUR MANAGER	1	2	3	4	5	N/A
OTHER MANAGEMENT	1	2	3	4	5	N/A
YOUR SUBORDINATES	1	2	3	4	5	N/A

The next few questions concern the amount of support your organization provides for computer users. Please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Disagree		Neither Agree nor Disagree		Strongly Agree
Q-26. I am convinced that management is sure as to what benefits can be achieved with the use of computers	1	2	3	4	5
Q-27. There is always a person in the organization whom we can turn to for help in solving problems with our computer systems	1	2	3	4	5
Q-28. A central support (e.g., information centre) is available to help with problems	1	2	3	4	5
Q-29. Training courses are readily available for us to improve ourselves in the use of computers . .	1	2	3	4	5
Q-30. I am always supported and encouraged by my boss to use computers in the performance of my job .	1	2	3	4	5
Q-31. Management has provided most of the necessary help and resources to get us used to computers quickly	1	2	3	4	5
Q-32. We are constantly updated on new software that can help us use computers more effectively	1	2	3	4	5
Q-33. Management is really keen to see that we are happy with using our computers	1	2	3	4	5

SECTION E

The remainder of the questionnaire asks for some information about yourself. This information is important to allow us to study the effects of differences between people on their feelings about computers.

Q-34. What is your organization's primary business? (Circle number)

1 MANUFACTURING
2 UTILITY (electric, gas, etc.)
3 MERCHANDISING
4 PUBLIC SECTOR
5 HEALTH CARE
6 INSURANCE
7 EDUCATIONAL
8 FINANCIAL SERVICES (e.g., banks)
9 OTHER
Please specify ______________________________

Q-35. How long have you worked for this organization?

______ YEARS and ______ MONTHS

Q-36. What is your functional area? (Circle number)

1 ACCOUNTING
2 ENGINEERING, DESIGN, R&D
3 FINANCE
4 GENERAL MANAGEMENT
5 MANUFACTURING/PRODUCTION
6 MARKETING OR SALES
7 INFORMATION SYSTEMS
8 HUMAN RESOURCES
9 OTHER
Please specify ______________________________

Q-37. What is the level of your position? (Circle number)

1 EXECUTIVE
2 MIDDLE MANAGEMENT
3 FIRST LINE MANAGEMENT
4 PROFESSIONAL
5 TECHNICAL
6 CLERICAL OR SECRETARIAL
7 OTHER
Please specify ______________________________

Q-38. What is your age?

______ YEARS

Q-39. What is your gender? (Circle number)

1 FEMALE
2 MALE

Q-40. Which is the highest level of education that you have completed? (Circle the last category that applies)

1 SOME VOCATIONAL OR HIGH SCHOOL
2 COMPLETED VOCATIONAL OR HIGH SCHOOL
3 SOME COLLEGE OR UNIVERSITY
4 COMPLETED COLLEGE OR UNIVERSITY
5 SOME GRADUATE WORK
6 A GRADUATE DEGREE

Q-41. What is your primary educational background? (Circle number)

1 ARTS
2 MATH/SCIENCE
3 SOCIAL SCIENCE
4 BUSINESS
5 ENGINEERING
6 LAW
7 COMPUTER SCIENCE
8 OTHER
Please specify ______________________________

Thank you very much for your assistance!

Please return your questionnaire in the envelope provided to:

Debbie Compeau
Project Co-ordinator
Computer Attitudes Survey
Room 1204, Dunton Tower
School of Business Administration
Carleton University
Ottawa, Ontario
K1S 9Z9

If you have any questions, or would like to discuss the survey further, please call me (613-788-3993).

APPENDIX F

COVER LETTER

for

FOLLOW UP QUESTIONNAIRE

[U.W.O. Letterhead]

[DATE]

[INSIDE ADDRESS]

Dear [NAME],

Last summer, I sent you a questionnaire concerning your feelings about and use of computers. Over 1000 people, including yourself, responded to the survey. The results look very promising in terms of expanding our knowledge regarding why people react in different ways to computers. However, more work is still needed in this area. In particular, we need to understand how feelings about computers change over time, and in what way these changes are related to use.

As a result, I am conducting a follow up to last year's survey. I have enclosed a copy of the Computer Attitudes Survey. I hope you will take the time to complete it (it should only take about 20 minutes). It is very important that we get as many responses from last year's participants as possible.

The results of this survey will be of practical significance to organizations in planning and managing the introduction of new technology, designing training programs for computer users, and in general, understanding user needs.

If you have any questions about the survey, please do not hesitate to contact me (613-788-3993).

Sincerely,

Debbie Compeau
Doctoral Student
The University of Western Ontario
Lecturer
Carleton University

APPENDIX G

FOLLOW UP LETTER

(for FOLLOW UP QUESTIONNAIRE)

[U.W.O. Letterhead]

[DATE]

[INSIDE ADDRESS]

Dear [NAME],

In November 1991, a questionnaire was mailed to you concerning your feelings about and use of computers. This questionnaire was a follow up to a similar survey conducted in the summer of 1990.

If you have already completed and returned the survey, please accept my sincere thanks. If not, please do so today. Because the survey was sent to only a small, but representative sample of professionals, it is extremely important that your responses be included in the study.

If by some chance you did not receive the questionnaire, or it got misplaced, please call me (613-788-3993 or 613-225-7882) and I will send you another copy.

Thank you for your assistance.

Sincerely,

Debbie Compeau
Doctoral Student
The University of Western Ontario
Lecturer
Carleton University

APPENDIX H

SUBJECT RECRUITMENT ADVERTISEMENT

-PILOT STUDY-

Advertisement for Subjects
-Pilot Study-

- Ad placed in classified section of local newspaper

Microcomputer Training Opportunity. Subjects needed for a study of computer training. 25-50 year old men and women are needed for a 2 hour training course in Lotus 1-2-3 or WordPerfect. Please contact Debbie Compeau (661-3206 ext. 4544) for further details.

APPENDIX I

TRAINING NOTES

-PILOT STUDY-

COMPUTER LEARNING STUDY

INTRODUCTION TO MICROCOMPUTERS

and

THE DISK OPERATING SYSTEM (DOS)

School of Business Administration
The University of Western Ontario

February 1991

OVERVIEW

Before we begin to learn WordPerfect 5.1 or Lotus 1-2-3, it may be helpful to review a few concepts about microcomputers and DOS.

The microcomputers you are using are Epson laptop computers. The Central Processing Unit (CPU), monitor and keyboard are all built into a single, portable case. There is a built-in "hard" disk (the C drive) which stores the software programs, and a floppy disk drive (the A drive - located on the right side of the computer) where you can store your data. The power switch is located on the back left corner of the computer.

DOS

Every computer needs a special kind of program called an operating system to make it easier for us to use. The operating system acts as a sort of translator between you and the computer. Commands that you enter are translated into the language that the computer understands.

The operating system used on most IBM (and compatible) computers is called the Disk Operating System or DOS. You can use DOS to do many things, including copy files, see what is on your floppy diskette, and start other applications (e.g., WordPerfect, Lotus 1-2-3). For today's session, we will only use DOS to start our applications.

STARTING THE COMPUTER

When you turn the computer on, a small program is automatically run to get the computer ready for you to use. When it is finished running, a "DOS prompt" will appear in the top left hand corner of the screen. It will look like this:

```
C:\>
```

This prompt tells you that DOS has been started, and that the computer is currently reading from drive C (this is the hard disk). The flashing line next to the DOS prompt is called the cursor. The cursor indicates your current position on the screen. When you type, the cursor shifts to the right and the characters you typed appear on the screen.

THE KEYBOARD

The keyboard looks something like the keys on a typewriter, but there are a number of extra keys.

Across the top of the keyboard are 12 function keys (labelled F1 to F12). The function keys are used to access common features of software packages. They are used differently in each package. Other keys that you should know about are:

SHIFT KEY	Used to type capital letters and the symbols displayed on the top half of the keys (if there are any).
CAPS LOCK KEY	When pressed once, capital letters are typed. Symbols and numbers are not affected. When pressed again, small letters are typed. A light in the top right corner of the keyboard indicates whether CAPS LOCK is on or off.
ALT KEY	Stands for Alternate Key. Used in combination with other keys (e.g., the function keys) to access different features.
CTRL KEY	Stands for Control Key. Used in combination with other keys (e.g., the function keys to access different keys.
NUM LOCK KEY	Works like the caps lock key. When turned on, pressing the keys on the number pad types the numbers. When turned off, the keys on the number pad have other functions (named on the bottom half of the keys).
ARROW KEYS	Move the cursor up, down, left and right.
PG UP, PG DOWN	Used to move up and down in larger increments (e.g., pages). Specific function depends on the software package.
HOME, END	Also used in cursor movement. Specific function is different for different software packages.
INS, DEL	The INSERT and DELETE keys are used in editing to make it easier to add and delete characters. Their specific function depends on the software package.

COMPUTER LEARNING STUDY

INTRODUCTION TO WORD PROCESSING

with

WORDPERFECT 5.1

School of Business Administration
The University of Western Ontario

February 1991

Overview

What is word processing?

A word processor is a particular kind of computer application with special features to handle written material. Word processing is more than just a computer based typewriter. With a typewriter, the words are put immediately to paper. Thus, in order to make changes to a page that was already typed, you would have to retype the entire page. In word processing, documents are stored electronically, and can be edited easily.

In the editing process, a number of special features make the task easier. Words can be automatically "searched and replaced." Blocks of text can be "cut and pasted" electronically, rather than retyped. An electronic dictionary assists in checking that words are spelled correctly.

What is WordPerfect 5.1?

WordPerfect 5.1 is a powerful tool for word processing. It is rapidly becoming the standard choice for businesses. Version 5.1 is the most recent release of Wordperfect, and incorporates the latest features. Other versions still available include 4.2 and 5.0.

In spite of the power of Wordperfect, it is easy to learn. Special features are accessed using the function keys, or with a simple menu. A help feature is built into WordPerfect to assist in using unfamiliar features.

We will work through a number of exercises to try out some of the main features of Wordperfect. Throughout the notes, the keystrokes that you actually type will be in **boldface** type. The symbol <enter> means to hit the enter key.

STARTING WORDPERFECT

At the DOS prompt (e.g., A:\> or C:\>)...

Type **wp <enter>** (Remember that <enter> means hit the enter key).

After a moment, the editing screen appears.

The editing screen represents a blank page. The bottom line of the screen is called the "Status Line." It tells you a number of things:

Document Name:	Once you have saved a document the name you gave it will appear in the lower left hand corner of the page.
Document Number:	In WordPerfect, you can work on two documents at once. The document number (e.g., Doc 1 or Doc 2) indicates which of those documents you are currently editing.
Page Number:	New pages are automatically started when a page is full. The page number tells you the number of the current page.
Cursor Position:	The rest of the status line tells you the position of the cursor on the page. The line is indicated in inches from the top of the page (e.g., Ln 1" means 1 inch from the top of the page). The distance from the left side of the page is indicated as Pos (e.g., Pos 1" means 1" from the left hand side of the page).

Occasionally, the information on the status line will be replaced by error messages or prompts.

BASIC TYPING

Using WordPerfect is as simple as hitting the keys on the keyboard. Most of the formatting is done automatically by the program.

For instance, try typing the paragraph below. As you type, notice how the cursor position changes. The Pos indicator increases as you move further from the left side of the page. Don't hit the enter key when you reach the end of the line. The program automatically starts a new line when it runs out of room. This is called "word wrap." Notice that when a new line is started, the Pos indicator starts over at 1", and the Ln indicator increases (since you are now further from the top of the page).

In the editing process, a number of special features make the task easier. Words can be automatically "searched and replaced." Blocks of text can be "cut and pasted" electronically, rather than retyped. An electronic dictionary assists in checking that words are spelled correctly.

CORRECTING MISTAKES

Deleting Incorrect Text

There are several ways to make corrections using WordPerfect. The Backspace key erases the character immediately <u>before</u> the cursor. The Delete key erases the character the cursor is on.

Try each of these keys to see how they work.

Inserting New Text

Sometimes it is necessary to insert a word in the middle of existing text. To do this in WordPerfect, just move the cursor to the place you want the text to go and start typing. The words to the right of the cursor shift sideways to make room for the new text. This is because WordPerfect is in INSERT mode.

If you hit the Insert key, WordPerfect switches to TYPEOVER mode. Notice that the word "Typeover" appears on the status line in the bottom left hand corner of the screen. Now if you start to type in the middle of existing text, the words to the right of the cursor will be deleted as you type over them.

If you hit the Insert key again, Wordperfect switches back to insert mode. It is usually best to work in insert mode.

SAVING YOUR WORK

When you are finished working on a document, you may want to save it electronically. The saved version can then be called up later and edited, or simply stored as a reference should you ever need to see what you wrote. To save a document:

Choose **F7**	Function Key 7 is the exit function. It will prompt you to save your work before quitting.

A prompt will appear at the bottom of the screen saying "Save document? Yes (No)".

Type y to indicate that you want to save the document.

Now you will be prompted to enter a filename (remember that the filename can be up to 8 characters plus a period and a 3 character extension). Type in the name you want to give your document and then hit the enter key.

A final prompt asks if you want to leave WordPerfect: "Exit WP? No (Yes)" If you type **y** you will return to the DOS prompt from which you started. If you type **n** you will stay in WordPerfect, ready to start a new document. If you want to stay in Wordperfect and continue working on the same document, choose **F1** (Cancel) as indicated by the prompt in the lower right hand corner.

For now, type **n** since we want to stay in WordPerfect.

REVISING AN EXISTING FILE

When you want to call up a file that already exists so you can work on it, start by listing the files on your diskette:

Choose **F5** (List). WordPerfect will show the directory name in the bottom left hand corner (e.g., Dir A:*.*). Press **<enter>** to indicate that this is the correct directory.

Now you will see a listing of the files on your A disk. You should see the file that you just saved listed among them, as well as other files that I saved on your disk for you to work on. Beside each file name is a number indicating the size of the file (in bytes) and the date and time it was created. At the bottom of the screen is a menu, indicating all of the things you could do from this screen. Option 1 is Retrieve.

To retrieve a file position the cursor beside the correct file (the file information will be highlighted) and type 1 for Retrieve. In just a few seconds (longer for really big files) the text will appear on your screen. Now you are ready to edit the file.

CURSOR MOVEMENT KEYS

A number of different keys are available to move around in a document. The following list indicates each of the keys (or combinations of keys) and summarizes their function:

ARROW KEYS	Move the cursor one character to the left, to the right, up or down.
CTRL-LEFT	Moves one word to the left.
CTRL-RIGHT	Moves one word to the right. Hold down the control key while you hit the arrow key.
HOME LEFT	Moves to the beginning of the line.
HOME RIGHT	Moves to the end of the line.
END	Moves to the end of the line.
HOME HOME UP	Moves to the beginning of the document.
HOME HOME DOWN	Moves to the end of the document. Hit the home key followed by the arrow keys.
CTRL-HOME	Go To: type a character to go to the first occurrence of that character Go To: type the number to go to a specific page Go To Go To: Ctrl-Home twice will return you to your previous position if you accidentally use the wrong cursor movement keys.
- +	Hitting the minus key on the number pad moves you backward one screen in your document, hitting the plus key on the number pad moves you one screen forward in your document. (The minus and plus keys in the regular typing area of the keyboard cannot be used for screen up/down).
PAGE UP	Moves the cursor to the first line of the previous page.
PAGE DOWN	Moves the cursor to the first line of the next page.

ENDING PAGES

There are two different kinds of page ends in WordPerfect. The first kind is inserted automatically when a page becomes full. This is called a "soft" page end, and will continue to adjust as you make corrections and edit the document. A soft page end is represented by a single line across the editing screen.

The second type of page end is called a "hard" page end. You can insert a hard page anywhere in your document that you want to start a new page. For instance, you might want to begin a new section of a report on a new page, regardless of whether the previous page was full. To do this, you use a hard page end. A hard page end is represented by a double line across the editing screen. To insert a hard page end type **CTRL-<ENTER>** (press and hold the control key while pressing the enter key).

MOVING A BLOCK OF TEXT

Sometimes when editing a document, you will find that a particular piece of text (e.g., a phrase, a sentence, a paragraph, several pages) needs to be moved to a different place in the document. Rather than deleting the text in one place and retyping it somewhere else, you can use WordPerfect to move it.

First move to the first character of the text you want to move. Choose **ALT-F4** (Block). Move the cursor to the last character of the text. Notice that the text is highlighted, and the words "Block on" are flashing at the bottom of the screen.

Now choose **CTRL-F4** (Move) to indicate to WordPerfect that you want to move the highlighted text.

A menu will appear across the bottom of the screen asking whether you want to move a block, a column, or a rectangle. Choose **1** (Block) to indicate that you want to move a block (you will almost never use the other two choices).

Another menu will appear across the bottom of the screen. This menu asks whether you want to move, copy, append or delete. Append is not very common, but the other three are very useful. Since we are trying to move the text, choose **1** (Move). The highlighted text will disappear from the screen.

The following prompt will now appear at the bottom of the screen: "Move cursor; press enter to retrieve". WordPerfect is asking you to tell it where you want to move the block to. Move the cursor to the location where you want the text to go, and press enter. The text has now been moved.

PRINTING A DOCUMENT

Once you have created a document, and edited it until you are satisfied, you are ready to print it on paper. As a final step before printing, I recommend that you preview a document. Previewing will show you exactly what the document will look like on paper.

Preview

Choose **SHIFT-F7** (Print). A menu appears with all of the options for printing. Number 6 in that menu is view document. Type **6** to choose this option. In a few seconds, you should see a "picture" of the current page of your document on the screen. Use **PAGE UP** and **PAGE DOWN** to move backwards and forwards through your document until you are satisfied that it looks OK. Now you are ready to print.

Printing

Choose **SHIFT-F7** (Print). Now choose **1** to print the full document. Wordperfect will now send your job to the printer. If you want to print just the current page, choose **2** from the print menu. Choosing **7** from the menu allows you to print several pages.

CHANGING THE FORMAT OF A DOCUMENT

WordPerfect is set up with certain default formats. Every time you start WordPerfect, those formats will be in effect. For example, the top and bottom margins are automatically set to 1" and 1". The left and right margins are also set to 1" and 1".

Most of the time, these default formats are just fine. Sometimes, however, you need to change them to suit a particular document. The Format menu **SHIFT-F8** helps you work through the formats to set them up as you prefer. If you change the format of a document in the middle, the format changes only apply to the text that follows the change.

Example

Suppose you wanted to change the left and right margins of the current document. You want to change the margins for the whole document.

Start by positioning the cursor at the very top of the document (use **HOME HOME UP** to take you there). Now choose **SHIFT-F8** to access the format menu.

Here you have four choices about the kind of format changes you wish to make. Changing the left and right margins is part of the line format.

Choose **1** (Line) to access the line format menu. The menu that appears gives you several options to change. Since we want to change the margins, choose **7** (Margins).

Your cursor will now be positioned under the left margin setting. The current setting is 1". Type your choice to replace the default setting (e.g., **1.5 <enter>**). Now your cursor is positioned under the right margin setting. Again type your choice (e.g., **1.5 <enter>**). Now choose **F7** to exit the format menu. (If you want to cancel your changes, choose **F1**).

OTHER USEFUL COMMANDS

Centering a Title

If you want to centre a title between the left and right margins, choose **SHIFT-F6** (Centre) and then enter the text. Hit **<enter>** when you are finished.

Bold

To enter new text in boldface:

Choose **F6** (Bold) and type the text you want to be bold. When you have entered the text, choose **F6** again to turn the bolding off.

To add boldface to existing text:

If you have already typed a word (or words) and you decide you want them to be boldfaced, you must first block the text and then choose bold.

Position your cursor at the beginning of the text you want bold. Choose **ALT-F4** (Block), then move your cursor to the end of the block. When all of the text that you want to be bold is highlighted, choose **F6**. The text is now bold.

Underscore

To underline new text, choose **F8**, then type the text, then choose **F8** again.

To underline existing text, first block the text using **ALT-F4** (as described for boldface) then choose **F8**.

Reveal Codes

The editing screen for WordPerfect shows only the text that you are entering, and not the formatting codes that will be used in printing (e.g., bold, centre, margins etc.). Sometimes it is necessary to see these codes, however, when you are trying to edit a document. In order to reveal the formatting codes, choose **ALT-F3** (Reveal Codes).

The editing screen is now divided in the middle by a highlighted bar. Above the bar is a smaller version of your normal editing screen. Below the highlighted bar, is the text with the formatting codes displayed too. "The cursor in the top screen (editing screen) is mirrored by a cursor in the bottom screen (Reveal Codes screen). The cursor in the Reveal Codes screen is normally a solid block that highlights each code or character as you move the cursor."[6]

By looking at the formatting codes in the Reveal Codes screen you can determine where to position your cursor to make your changes.

Spell Check

To check the spelling of your document, choose **CTRL-F2** (Spell). A menu appears at the bottom of the screen, asking if you want to check a single word, a page, or a document (among other things). Enter your choice (e.g., **3** to check the whole document).

The message *Please wait* will appear at the bottom of the screen while WordPerfect checks your document. If it finds a word it does not recognize, a split screen will appear. Your text will appear in the upper screen, with the incorrect word highlighted. In the lower screen, several alternate spellings will appear. Type the letter next to the correct choice to select one of these.

You can also tell WordPerfect to skip that word (either once or every time it appears in this document) if you don't wish to change it by selecting options **1** or **2** from the menu at the bottom of the screen. Alternatively, you can add the word to a permanent supplementary dictionary (choice 3).

Thesaurus

WordPerfect also contains a thesaurus (or list of similar words) to assist in writing. Position your cursor under the word you want to look up (e.g., similar). Then choose **ALT-F1** to access the thesaurus. A list of equivalent words will be

---

[6]. Wordperfect Workbook for IBM Personal Computers, p. 21.

displayed on the screen. You can look up any of these words by typing the letter next to it. Choose **F7** when you are ready to leave the thesaurus.

Exercises

1. Work through the first 5 pages of these notes (from "Starting WordPerfect" to "Saving your Work".

2. Retrieve the file OFFICE.WP5 that is stored on your A disk. This file contains an excerpt from the first draft of a chapter on Office Technology. The setup of 3 different firms is described.

   a) Try the different cursor movement keys to move around in the document.

   b) The firms described in the chapter represent small, medium and large offices. In the first draft, however, the medium sized accounting firm is described first, followed by the small law office and then the large sales office. To improve the flow of the chapter, move the paragraphs concerning the law office to the beginning of the document.

   c) Once you have successfully moved the section of text, save your changes. Then print the file.

   d) The publisher requires that 1 1/2 inch margins be left for editing notes. Change the left and right margins to 1 1/2". Now change the top and bottom margins to 1 1/2".

   e) The titles of the sections don't stand out very well in the current draft. Make these titles boldfaced.

   f) A section of text to introduce the three mini-cases has been drafted on paper. Try entering this section into the document. It should be double-spaced and have the same margins as the rest of the text. Remember that you have added formatting codes at the beginning of the document. This section of text will have to go after those codes. Use **ALT-F3** (Reveal Codes) to position your cursor after the codes. Then enter the text.

PUTTING THE PIECES TOGETHER

The preceding sections have described individually the components that make up typical office systems. The remainder of this chapter looks at the implementation of these technologies for 3 hypothetical offices. The first is a small private law office. The second, is a medium sized accounting firm, with 3 partners and several assistants. The third, is the sales office of a national consumer goods manufacturer. Each of these offices requires a different configuration of office technologies to meet its particular business needs.

g) On the printed document, you will notice that there are no page numbers. Let's add them following these steps.

Choose **SHIFT-F8** to access the format menu.

Look at the list of choices associated with Page format (option 2). Notice that page number appears in this option. Select **2** to change the page format.

Select **6** to change the page numbering format. Then select **4** (Page Number Position).

A screen now appears showing all of the different possibilities for page numbering. The page on the left side of the screen shows options if you want the page numbers in the same place on every page. On the right side of the screen, there are options for printing page numbers on opposite sides of successive pages (like the page numbers in a book). We'll just print them in the same place on every page. Choose **3** to put the page numbers in the upper right hand corner. Now choose **F7** (Exit) to return to your editing screen.

h) In the current draft, the text has a "ragged right" margin. An alternative to this format is a fully justified format, where the text forms a rectangular block on the page. Using the format menu, try to change the text to a fully justified format.

i) One final enhancement to the document has been requested. The publisher would like a line in the top left corner of each page describing the document. This line is called a "Header". Using the format menu (again) try to add the following header:

CHAPTER 3 - Office Technology

If you get stuck, try **F3** (Help).

j) Check the spelling of your document. Print the final version.

COMPUTER LEARNING STUDY

INTRODUCTION TO SPREADSHEETS

with

LOTUS 1-2-3

School of Business Administration
The University of Western Ontario

February 1991

Overview

What is Lotus 1-2-3?

Lotus 1-2-3 (Lotus) is a popular software package for financial analysis. Lotus spreadsheets can be used for budgeting, analyzing trends, creating graphs, sorting data, statistical analysis, and a variety of other tasks. It is a powerful package which can be tailored to suit specific applications.

A Lotus spreadsheet is a rectangular grid of columns and rows. Information (either text or numbers) is entered in cells (a cell in the intersection of a column and a row). This information is then manipulated using Lotus. For instance, a column or row of names can be sorted alphabetically. Numbers can be summed and averaged. Complex mathematical formulae can be applied to manipulate the data.

While Lotus is a very powerful tool, it is relatively easy to learn. Only a few basic commands are needed for simple applications. Once you have mastered these, you can learn additional features by experimentation. A help feature is built in to Lotus to assist you in using unfamiliar functions. Moreover, since Lotus is so popular, a variety of books are available to help you learn.

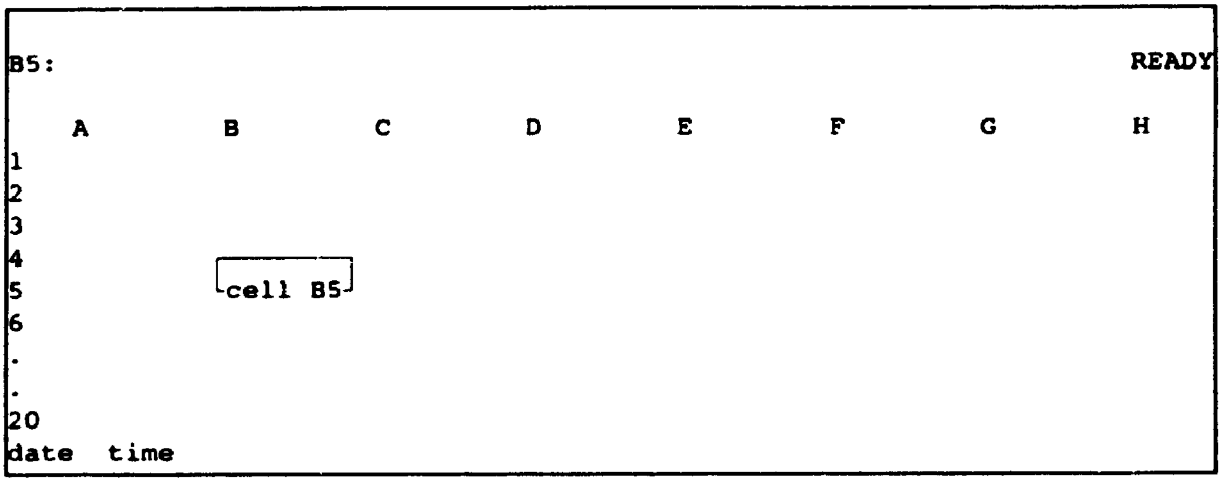
We will work through a number of exercises to try out some of the main features of Lotus. Throughout these notes, the keystrokes that you actually type will be in **boldface type**. The symbol <enter> means to hit the enter key.

STARTING LOTUS

At the DOS prompt (e.g., A:\> or C:\>)...

Type **123** **<enter>** (Remember that <enter> means to hit the enter key)

After a moment, the worksheet appears. A screen approximating that shown below will display.



```
B5:                                                              READY
    A        B        C        D        E        F        G        H
1
2
3
4
5            cell B5
6
.
.
20
date   time
```

This is a "window". It consists of 8 columns (A to H) and 20 rows. Each column is 9 characters wide. The intersection of a row and column is called a cell. Cell B5, then, is the intersection of column B with row 5. B5 is called the cell address. A cell pointer highlights the current cell. The address of the current cell is shown in the upper left corner of the screen.

The "mode indicator" is in the upper right hand corner of the screen. When the indicator says READY, you can enter information into the cells of the spreadsheet. In MENU mode, you can make choices from the Lotus menu. In POINT mode, you move the cell pointer to point to particular cells. (We'll talk more about MENU and POINT modes later).

MOVING AROUND THE SPREADSHEET

A number of keys are used to move around the spreadsheet quickly. A summary of the main keys and their function follows:

ARROW KEYS	Move the cell pointer one cell in the indicated direction.
HOME	Moves the cell pointer to cell A1.
END HOME	End key followed by the home key. Takes you to the last cell entry in your spreadsheet.
PG UP	Moves the screen up 20 lines.
PG DOWN	Moves the screen down 20 lines.
CTRL-ARROW	Moves the screen 80 characters to the left or right.
END ARROW	End followed by an arrow key will move the cell pointer to the next beginning or end boundary of your data.
NUM LOCK	Allows the number pad to be used for entering numbers.
F5	Function key F5 is the GOTO key in Lotus. It will prompt you to enter a cell address. The cell pointer will then be moved to that address (e.g., pressing **F5** and then responding **G22** will move the cell pointer to column G, row 22).

USING THE MENUS

The / (slash) key is the most important key in Lotus 1-2-3. Pressing this key accesses the Lotus menus. The menu appears across the top of the screen. Underneath the row of menu choices is a list of subcommands that are accessed by selecting the highlighted choice. To select commands from the menu, use the arrow keys to move left or right until your choice is highlighted. Then select enter.

If you want to get out of a menu, hit the esc (escape) key. You will be returned to the next higher level menu (or to READY mode). Keep hitting esc until you are in READY mode.

We will talk more about using the menus when we look at specific commands. For now, remember how to access the menus (the / key) and how to "back out" of the menu (the esc key).

In order to see how Lotus works, let's create a simple spreadsheet. We will enter the following budget for Ted Smith.

	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Wages	2000	2000	2000	2000	2000	2000	12000
Expenses:							
Rent	475	475	475	475	475	475	2850
Food	362	362	362	362	362	362	2172
Clothing	150	150	150	150	150	150	900
Car Insurance	357					357	714
Car Expenses	94	94	94	94	94	94	564
Life Insurance	277					277	554
Loan Payment					731	731	1462
Leisure	200	200	200	200	200	200	1200
Savings	278	278	278	278	278	278	1668
Total Expenses	2193	1559	1559	1559	2290	2924	12084
Balance	-193	441	441	441	-290	-924	1281

ENTERING LABELS

The first step in entering a spreadsheet is to enter the labels. We'll begin with the column labels. Since the first column will contain the labels for the types of expenses, we should enter the headings for JAN to TOTAL starting in column B.

Turn the CAPS LOCK on to get all capital letters for the headings. Move the cell pointer to B1 and type "JAN <enter>. As you type, notice that the text does not immediately appear in the cell. It is typed at the top of the screen, below the cell address. When you hit the enter key, the text appears in the proper cell.

The " at the beginning of the title indicates that the title is right justified (aligned with the right side of the cell). To centre an entry type ^ instead of the " at the beginning. If you want the entry to be left justified, type '. When the label starts with a letter, the single quote (') does not have to be typed and the entry will be automatically left justified. NOTE: The " ^ and ' are called label prefixes. They identify the entry in the cell as a label and therefore, not data. If you enter a number using one of these label prefixes, you will not be able to perform mathematical operations on that number.

Now move to C1 and type **"FEB <enter>**, and so on until all of the column titles are entered. Then move the cell pointer to cell A2 and begin entering the row titles.

SAVING A FILE

Once you have created a spreadsheet, you may want to save it for future reference. To save a file, you must first access the Lotus menu.

> Type / (slash) to access the menu. Now choose FILE from this menu. Use the arrow keys to highlight the word file, then press enter. (You can also type the first letter of any menu item to access it). Next, choose SAVE from the menu.
>
> You will be prompted to enter a file name. The file name can be up to 8 characters in length. Once you have typed the name, press **<enter>**. Lotus will automatically add the extension .WK1 to your file name.
>
> If a spreadsheet with the same name as you chose already exists, you will be asked if you want to REPLACE the stored version with your spreadsheet, or CANCEL the command.
>
> To save Ted Smith's budget, choose FILE SAVE and then type **budget <enter>**. The file BUDGET.WK1 will now be saved on your A disk.

ERASING A SPREADSHEET

Now that your spreadsheet is saved, you may want to clear the spreadsheet from the screen to work on something else. Erasing the spreadsheet does not affect the copy that you saved on your disk.

To erase the spreadsheet, first access the Lotus menu. Now select WORKSHEET from the menu. Then select ERASE to indicate that you want to erase the current worksheet from Lotus' memory. Next you will be asked to confirm that you want to erase it. Choose YES and the spreadsheet will be cleared. Choose NO and you will return to the READY mode.

RETRIEVING AN EXISTING FILE

If you want to make changes to a spreadsheet that you have already saved, you must retrieve the file into Lotus.

Access the Lotus menu. Now select FILE from the menu. Next, select RETRIEVE. A listing of the files stored on your disk will appear where the menu was. Move to highlight the file you want to retrieve and hit **<enter>**. In a few seconds, the spreadsheet will appear on your screen.

Retrieve the file BUDGET.WK1 (Ted Smith's budget).

ENTERING DATA

Now that the column and row titles are set up, you are ready to enter data into the spreadsheet. First, move to column B2 and type **2000** **<enter>**. The number will appear in the cell. Repeat this procedure in cells C2 through G2.

Correcting Errors

If you make a mistake while entering information into a spreadsheet, position your cell pointer in the cell to be changed, and choose **F2** (Function Key 2 - Edit). Now you are in EDIT mode and you can change the entry. The BACKSPACE key deletes the character immediately before the cursor. The DELETE key deletes the character the cursor is on.

As an alternative, you can just retype the entry and Lotus will replace the incorrect version with what you type.

Erasing Entries

If you want to erase an entry from a cell, move to that cell, and press the **SPACEBAR.** Then hit **<enter>**. The old entry has been replaced by a single space. If you want to erase the entries in many cells, select RANGE followed by ERASE from the Lotus menu.

You will be prompted to enter the cell addresses of the starting and ending cell in the range. You can either type in the range (e.g., B19..J20 - this would erase all of the entries in the rectangular area from column B to column J and row 19 to row 20), or you can point to the range.

Pointing to a Range

A range in Lotus is a rectangular grouping of cells. The smallest range is a single cell (e.g., A2 is a range that is 1 column wide and 1 row long). When using Lotus commands to point to a range, the range will appear in the menu area.

To point to a range, move the cell pointer to the first cell (e.g., B19). Then press **.** (period) to anchor one corner of the range. (Notice that the range indicated in the menu area now says B19..B19). Next, move your cell pointer to the last cell in the range (e.g., J20). The rectangular area should now all be highlighted, and the range in the menu area should say B19..J20. Hit **<enter>** and the range will be erased.

FORMULAS AND FUNCTIONS

When entering a budget such as Ted Smith's, we can get Lotus to add up the columns and rows (and do any other arithmetic required). For instance, to get the total wages for JAN to JUN, we can enter a formula.

Formulas always start with a plus sign. This tells Lotus that what follows is a mathematical operation and not a label. To enter a formula for Total Wages, move the cell pointer to cell H2, and type:

+B2+C2+D2+E2+F2+G2

The total (12000) should appear in cell H2.

Some very common formulae have been set up as FUNCTIONS in Lotus. For instance, instead of typing the formula above, we could have used the SUM function. Functions always begin with the @ sign (SHIFT 2) to indicate that what follows is a function. To sum the wages for JAN to JUN, we could type (in cell H2):

@SUM(B2..G2)

This tells Lotus to add up all of the entries in cells B2 up to and including G2, and to place the result in the current cell. A list of FUNCTIONS can be found in the help facility (choose **F1** to get into HELP).

COPY COMMAND

As we prepare to enter the rest of the data for Ted Smith's budget, we can see that a lot of the entries are the same. For instance, Rent, Food, Clothing, Car Expenses, Leisure, and Savings are the same for every month. Rather than entering the same numbers over and over again, we can enter the value once, and copy it into the rest of the cells.

Start by moving to the cell where January's rent expense should go (e.g., cell B5). Type the entry **475 <enter>**.

Now access the Lotus menu by typing / (slash). Select COPY from the menu. You will be asked to indicate the range you want to copy from. We want to copy from cell B5.

Point to the range you want to copy from. In this case it is a single cell (B5..B5). Once the correct range is indicated in the menu area (and highlighted on the screen) hit **<enter>**.

Next you will be asked to indicate the range you wish to copy to. To point to this range, move the cell pointer to the first cell (C5) and press **.** (period) to anchor the range. Now move the cell pointer to the last cell (G5) and hit **<enter>**. The values will be copied.

We can do the same thing for the other fixed expenses.

Copying Formulas

Formulas can be copied in the same manner as values. For instance, the formula for Total Wages can be copied into the rest of the TOTAL column.

When a formula is copied, however, the cell addresses are adjusted so that the formula works on the cells in the same position relative to the current cell.

For instance, if the formula for wages in cell H2, @SUM(B2..G2), was copied into cell H5 the copied version would actually read @SUM(B5..H5).

OTHER USEFUL FUNCTIONS

Setting Column Widths

To change the width of every column in the spreadsheet (the default width is 9 characters), select WORKSHEET, GLOBAL, COLUMN-WIDTH from the menu, and then enter the desired width (e.g, **15 <enter>**).

To change the width of a single column, position the cell pointer in any cell of the appropriate column. Select WORKSHEET, COLUMN, SET-WIDTH from the menu, and then enter the desired width.

Inserting Columns or Rows

Position the cell pointer in the column immediately to the right (for columns) or below (for rows) the place where you want a new column inserted.

Select WORKSHEET, INSERT, COLUMN (or ROW) and hit **<enter>** and the new column is added. Notice how the other columns or rows shift to make room for the addition.

Deleting Columns or Rows

Position the cell pointer in the row or column to be deleted. Select WORKSHEET, DELETE, ROW (or COLUMN), and hit **<enter>** and the row or column will be gone.

Formatting a Range

Since all of the information that we have entered into the budget for Ted Smith represents dollar amounts, we might want to define these cells as currency. To do this, we select RANGE, FORMAT from the menu, select the type of format we want (currency) and then point to the range we want defined as currency (as we did for erasing and copying).

Other useful formats are: scientific notation, fixed number of decimal places, and commas inserted to break up thousands.

You can also define a format for every numeric cell in the spreadsheet by selecting WORKSHEET, GLOBAL, FORMAT and then choosing the desired format.

Printing a Spreadsheet

Move your cell pointer to cell A1. Select PRINT from the menu. You will be asked whether you want to print to the printer or to a file (if you print to a file, you can retrieve the data into a package such as WordPerfect). Choose PRINTER to get a hard copy of your spreadsheet.

Now you will be asked to indicate the range you want printed. Point to the range (if you started in cell A1, press . to anchor the top corner, then hit **END HOME** to move to the last cell entry, then hit **<enter>** to accept the range).

Now make sure that the paper in the printer is positioned at the top of a page, and select ALIGN. Then choose GO. You will be returned to the Print menu. Choose QUIT (or hit ESC several times) to get back to READY mode.

LEAVING LOTUS 1-2-3

When you are ready to leave Lotus, access the menu (type /). Choose QUIT from the menu. You will be asked to confirm that you really want to quit. Select YES to exit Lotus, NO to return to the spreadsheet.

APPENDIX J

SCRIPTS FOR MODELING VIDEOTAPES

Script #1: WordPerfect (female)
- dropped after pretest

Well, here we go. I'm supposed to keep talking as I go...to say what I'm thinking. So. What am I thinking...I'm thinking that I'll never remember everything from the lecture. There was just so much to learn.

OK. Calm down. Let's just try to work through some of these exercises and see what happens.

(READS) "STARTING WORDPERFECT: At the DOS prompt...what's that...oh yeah, that's where it says c:...type WP ... OK **(types WP)** and hit enter...where is the enter key...oh, there it is **(hit enter)** **(now waits and watches screen)**

There it is! **(reads some more)** "The editing screen represents a blank page...status line...**(as if skipping words)**...OK. There's the document number **(the instructor said that wasn't very important for now)**...the page number and cursor position. So, I'm on page 1. And **(READ SILENTLY)** I'm 1" from the top and side of the page. Neat.

Now, the first exercise is to type this paragraph here.

In the editing process, a number of special features make the task easier. Words can be automatically "searched and replaced." Blocks of text can be "cut and pasted" electronically, rather than retyped. An electronic dictionary assists in checking that words are spelled correctly.

(TYPES - MAKES LOTS OF MISTAKES, SIGHS, BACKS UP TO CORRECT EACH ONE, HUNTS FOR KEYS ETC.) Oops. I've made a mistake here. How do I fix that **(READS)**. Backspace or delete. Let's try backspace. **(MOVES BACK, DELETES the wrong character)** Oh, I get it, the backspace key deletes the character before the cursor thing. **(READS)** Now I'll try delete. OK. **(DELETE a character)** It deletes the character where the cursor thing is. Just like it says in the notes. **(CONTINUE TYPING. MAKE MORE MISTAKES, CHECK NOTES A COUPLE MORE TIMES TO REMEMBER HOW TO CORRECT, THEN FIX)** **(WATCH FOR CURSOR WRAP AT THE END OF THE LINE)** Oh. Look at that. It jumped to the next line when it got full. Hmm. And it says Ln 1.19 now at the bottom. I guess that means I'm that far from the top of the page.

(AT THE WORD "spelled" IN THE LAST LINE, MAKE ONE MORE MISTAKE, GO BACK AND CORRECT IT A BIT HESITANTLY, BUT LESS

SO THAN BEFORE AND WITHOUT LOOKING AT THE NOTES, THEN FINISH THE PARAGRAPH).

There, **(SIGH)** finally. OK. Now what. **(READS)** Save the file. How do I do that? Here it is. F7. So I push that. **(push F7)** now what? **(look back to the notes)** At the bottom it says "Save document?" Oh. so it does. I type "y" to say that I want to save it. **(type y, then back to notes)** Now the filename. It's asking for the filename. How about FIRST. **(type first, wait a minute)** Nothings happening. Oh, I have to hit enter. OK. Now it says **(READING FROM SCREEN THIS TIME)** "Exit Wordperfect?". Do I want to exit. **(Look down at notes)** No, I want to keep working... **(type n)**. Hey. where'd my stuff go. **(Looks at notes)** Oh, this is a new document. I hope mine is still on the disk.

(push up sleeves or something "getting down to business") Next exercise. Here we go. **(READS)** I'm supposed to be working on a file called COLDS. I have to retrieve it, and make a bunch of changes. How do I start. "REVISING AN EXISTING FILE" Oh, here it is. **(READS)** Choose F5. **(push F5...wait for something to happen. then notice the a: in the bottom, flip back to notes)** Oh, hit enter. **(Do so)**

(LIST SCREEN APPEARS) Hmm. OK. Oh, there's my file. It was saved. So once it's on the disk, it stays there. Now, I'm supposed to get this other file "COLDS" or whatever. **(READS)** So, put my cursor on it. Now...yes, there's the menu at the bottom...type 1 for retrieve. There it is. Great.

So, First I have to make these changes to the file. Let me see. I have to add the word 'very' between these two. How...**(reads)**? Move the cursor over to there. **(move cursor one place at a time)** Now just type **(sceptical, but types anyway)**. All right **(satisfied)**. That's kind of neat. I type, and it pushes stuff over to make room for it. Now, I have to add this comma **(does it, same way - actually, put the comma one space too late, then fix and remember the rule)** OK, it inserts right where the cursor thing is.

Now, This is supposed to start a new paragraph here. How would I do that? I wonder if I can just...let's try this...**(hit enter)**...Yeah. I can just hit enter and it drops down one line. Now if I hit it again **(does so)** it will leave a space. Hey, I think I'm getting this.

I have to change this word here, where it says decongestents I have to make the e an a. OK. Well, if I move there and type a it will just add it in. **(PAUSE)** Oh, of course, then I delete the other one. **(make the change)**

Next I want to move these lines. Hmm. **(READS)** It says to block the lines using alt-f4. So, I move to the start, push alt-f4...now it says block on...now I move to the

end of the block. **(READS)** until right after the last character to be moved. That would be the t in throat. Now, **(READS)** I press Ctrl-F4 to get move. Block, column or rectangle???? Well, I guess a block. Choose 1. Now, it says Move, Copy, append, delete. I want to move, so I guess I choose 1. To where? Well, **(moving cursor)**. I guess to here. Now hit enter to put it there.
Huh. That's pretty neat. But there isn't a space here, and there's an extra one there, so I guess I'll just have to fix those. **(goes through and fixes them)**. OK.

(keep fixing the document, and talking in the same way as you go. Don't worry about mistakes, just keep backing up and fixing them.)

There I'm finished making the changes. This isn't as bad as I thought. I mean, there's still a lot to remember, and I still make a lot of mistakes, but I'm actually getting this. I guess I just have to keep going, and trying things out.

(Looks down at book to read something else. Fade away.)

Script #2: WordPerfect (male)

Here I am. I'm just going to do these exercises here. **(reading from notes)** Number 1. Start Wordperfect and then type this paragraph here. OK. Then what. **(Reading some more)**. Retrieve the file "colds" and make the changes shown on the attached sheet **(look at attached sheet)**. OK.

I think maybe first I'll just read through some of these notes a bit. **(Start Reading and underlining)**. I'm just underlining things here so I know where to find them if I need to. Keep reading **(CAMERA FADE...)**

Oh.. Now this is kind of interesting. Here it says I can get help if I need it by pressing F3. Let me try that. Where's F3. **(hunt through the keys to find it) (Press F3)** Nothing happened. **(press again, twice)** Why isn't that working? **(look back to notes)** Oh, I see. I have to be in WordPerfect to do that. That makes sense. **(to the camera...)** Great start eh?

OK. Let's get WordPerfect started. Hmm. **(flip through notes)**. Here it is. Starting WordPerfect. Type wp and then enter. Got it. **(hunt a bit for keys, type wp with one finger, then put hands back into lap)**

(Wait while WordPerfect starts up) Now let me get back to finding help. That was F3 I think. **(press F3 - now read the screen over)** I see. Now if I want help, I just type a letter and it gives me a list of things beginning with that...like an index. Let's look at 'B' **(find and type b)**. Now, what. I've got a list here, but what do I do with it? Let me try moving the arrows. Whoa. That didn't work. **(Read aloud from screen a bit)** That just gives me help about the arrows. **(Stare for a while. Hit a few more keys - e.g., escape, F3 again)** I'm stuck. **(Stare some more)**. Oh, here we go. At the bottom here, it tells me how to get out of help. Hit enter **(Do So)**.

Now, let me try this again. **(Hit F3, then read the Help screen)**. OK. I get it now. When I want help, I can get an alphabetical list of things, and it shows me what key to hit to actually get information about it. That's why it showed me the arrow stuff and the escape stuff. So. Let's do u' again. Now Backspace...and the next column tells me to hit the backspace key to get information **(Hit backspace)** There it is.
(Read the information about backspace out loud). Now, to exit, just press enter.

That's really great. It's like having all the notes on the computer. Bet I'll use that a lot, eh?

Well, now. Let's get down to business. I'm supposed to type something in here. **(look at notes)** Here it is, this paragraph here.

(**In the editing process, a number of special features make the task easier. Words can be automatically "searched and replaced." Blocks of text can be "cut and pasted" electronically, rather than retyped. An electronic dictionary assists in checking that words are spelled correctly.)**

(Start typing. One or 2 fingers only. Really slow. Stop after the first two words) This is the worst part. I don't know how to type very well. It takes me a while to find the keys. Maybe I'll get faster as I go.

Start typing again. **(CAMERA FADE..Pick up again at word "spelled"). (finish)** Whew. I'm glad that's done. **(Reads)** now I'm supposed to save this. Umm. That's F7, I think. **(Do so)**. Now it asks if I want to save the document. Yes. How do I type that though. Do I press Y? **(try it)** Oh, yeah. OK. Now it says "Document to be saved"...well, yeah, but I already said that I wanted to save it, what's this now? **(pause)** It must be asking for the name. I get it. It's a Miracle, so that's what I'll call it. **(Type that in)**. Do I want to exit WP? Sure, why not. **(type y)**.

Now I'm back where I started from.

(Reads) Next I have to call up the file "colds" to make some changes to it. First I have to start WordPerfect though. **(types WP, enter, WordPerfect starts)**

OK, so I have to get this file and make the changes from the other sheet. Now, how do I get that. Umm. Let me try help again. **(press F3)** But what letter. How about 'f' for file. OK. Here we are. File Location, File Management, File search. None of these look like a way to get a file **(stare for a minute)** Well, most of these use List, which is F5, so maybe I'll try that. Oh yeah, but first I have to get out of help. I almost forgot. **(exit help and then push F5)**. Now it says Dir a:*.*. Is that asking me where to look??? **(Think for a minute)** Yeah, it must be. OK. Sure. I'll hit enter. Here's a list. Yep. There's my other file, and the file I'm supposed to work on.

(think for a bit). Across the bottom here, there's this list of things to do. Oh, yeah, and the first one is "retrieve". That must be it. So, I press '1'. Nothing happened. What did I do wrong? Umm. Oh, I guess I have to highlight the file first. **(now do it right)** Great. Here it is.

So, I just have to make these changes here. Hmm. I have to add this word "very" in here. So, what, do I just type it? Must be. **(Move down to the space between be and mild, then type the word very)** Well, that's almost it, but the spaces are wrong. I guess I just go back and put another one in. There. Now I do these others. **(Make the other changes the same way)**.

Oh, this one is tougher. I have to move this stuff up higher. (stare for a minute) Back to the help again. **(to camera)** See, I told you I'd use it a lot. **(press F3)**... and that's M for move **(press M)** Huh. I don't see it here. Oh, press m for more. Here's move. But, I don't know. Move Block??? Maybe. Move Down, No. Move Left, no. Well, let me look at the next screen. **(press m and read)** Oh, there it is, Move Text.

OK now, to look at that I have to press...what's this Ctrl-F4? Oh that's right. I remember. That means that I push those two keys together. OK..Let's try that **(press ctrl followed by f4)** Indent???? That's not right. I must not have pressed them right. Let me try again. **(press them together)** OK. Here's move. Boy, you really have to time it right or you get all kinds of weird stuff.

I'll just read through this. **(Stares at screen - read the whole page)** OK. First I have to block it. Then I press this Ctrl-F4 to move it. **(pause)** And I do that using Block. **(pause)** But how do I get a block. I can't figure this out. **(exit help, stare at screen, then look down at notes flip to page 7 & read)** OK. Here it is here, too. This is easier to follow.

Right. I go to the start. **(move to the beginning of the block)** I press alt-f4...hey I just noticed this thing by these 'f' keys. It tells me what all the keys do. Here's alt-f4 and ctrl-f4. Yeah.

Anyway. **(press alt-f4)** I press alt-f4. Now it says block on. So I move to the end of the stuff. Now it's all highlighted. So. Now I want to move **(look at template)** So I push ctrl-f4. **(read menu at bottom)** I guess it's block **(choose 1)**. Now...**(read menu again)**...move... So that would be 1. OK. Hey, it disappeared. **(moment of panic)** But it says that I can hit enter to get it back. **(hit enter right here so it comes back where it was)** Got it. But it's right where it was. Hmm. Let me try this again. **(hit alt-f4, block the area, hit ctrl-f4 & 1 for block, and 1 for move)** It disappeared again! **(pause)** Oh, I see, I have to move it where I want to go and <u>then</u> hit enter.

So I move it up here **(move cursor)**...and press enter. **(do so)**. There it is. **(fix up any spacing problems)**

(Go through and make the rest of the changes. Ad lib like before) **(Finish the changes.)** There. That looks nice. I wonder if I can print it. Let's see. **(look at template)** Here it is, F7...but it's green... so it's shift-f7. OK. **(press shift-f7, then read screen)**. I guess its a full document. So that's 1. **(press that)**

(Printer starts) Now, I'll just wait for that. **(Continue to flip through the notes, while printer finishes)**. That's done. Let me just get that. **(Tear off page and sit back down)**. Hey. This looks great. Not bad for my first try.

You know, it's amazing...before this course I really didn't think I could do this. But I can. Great!

(Now I'd like a camera shot of the page in his hands to finish)

Script #3: Lotus 1-2-3 (male)

Right. This is it. I'm going to do these things with Lotus. I'll keep talking as I go. I'm supposed to say what I'm thinking about. The class was OK, but there was a lot of material to learn. And it's hard to figure things out sometimes without doing them yourself. So I'll have to practice a lot before I feel really comfortable with this.

I'm going to start Lotus now, and then I'm going to type in this monthly expenses table. Let me just take a minute to look at my notes...**(read a bit from the notes)**.

The first thing I have to do is type 123 and then hit enter. I think I can do that. **(type 123 & enter)**. OK. It's doing something, because the screen went blank. It worked. Here's Lotus.

I'm supposed to try out some of these keys to move around the worksheet. I'm in the top corner now. That's A1. If I push the arrow keys **(try 1 or 2)** I move across or down one place. OK. Got that. If I push page down, **(try it)** I end up in row (whatever the row is). If I push the control key...where's the control key...oh, here it is...If I push it with the right arrow key, I move over to the next screen. Now I can see columns I to P. OK. Now if I push home **(try it)**, I go back to A1. Hmm, so there's lots of ways to get where you need to be.

So, now I want to enter this table here. What's it say here **(read)**. OK. First I enter the column and row labels. I start in B1. So I move over to there **(push arrow key, hold it down too long and it will scroll too far)** Oops. It got away from me there. I held it down too long and it went over a lot of columns. Now I'll have to go back to here. OK. That's better.

January - OK, I'll type that in. **(type January & enter)** There. So now I'll type February **(type but don't enter)** Wait, I'm supposed to put this in C1. So, I'll just move over there with the arrow...What happened??! Now I've lost January, I've got February in B, and nothing in C **(stare)**

Oh, when I hit the arrow key it moved to C, but it put February in B over top of January. **(pause)** Well, then I guess the arrow key is sort of like hitting enter and then moving.

Now, to fix this, I have to go back and type January again **(do so)**. Now, I have to move the highlighted area over to C <u>before</u> I type February **(do that now, then continue typing the column headings - all the way over to TOTAL)**.

Now. I want to put in the row headings. Let's see. I start in cell A2, no, maybe A3 - that way I'll leave a space below the months. OK. I move over to there. Now...I type in "Wages" **(type that in)**. Now, I move down 2, and type in Expenses. Rent next. **(& keep going until Car Insurance)**. Now, car insurance **(type it in and hit enter)**. Oh. That goes over into the next cell. Hmm. What will that do to my table? **(reads, flips pages)**. I see. I can make this column a bit wider, and then it won't overflow like that.

Let's see. I type slash to get the menu...I remember that much from class. Now. Is it worksheet? Or maybe range? Hmm. **(read)** Oh. It's worksheet. So I move over till that's highlighted. Then hit enter **(do so)**. Now, **(look at notes)** It's column **(choose column)** ...and then set width **(choose it)** OK.. How wide should it be? Let's see. Oh, I guess 20 spaces should be lots. So, I type in 2 0 **(as you're typing)**. And then enter. OK, good! Now there's lots of room. So, now I can keep typing these things here **(keep typing the labels)**.

Now. I want to type in the numbers. So I start in cell B3, now, so that it's in the right column and row. **(move to B3)** There. OK. It's 2000. So, I type in that **(type 2000)** and here it is. OK. Now I want to put the 2000 in the other columns too. So, I move over here **(Move to c3)** and type it again...and then I move...**(keep going and typing it in. When you finish May, pause for a second)**. Hey, where's June? **(pause then move with arrow key)** Oh, it was off the screen now. Right, because I made the first column wider.

OK. Now what? Oh. Rent. But this time I'm supposed to copy the number over from the first column. Ooh **(hesitantly, then pause and look at notes a minute)**. OK. So, I type in the first one...that's 475. OK. Now, how do I copy **(flip through the pages)**. Here it is.

OK. I'm supposed to start from this cell where the 475 is. OK. Now, I get the menu. That's the slash. Now I choose copy **(do so)**. Now, it says range to copy from. **(look at notes)** Right, that means "what do I want to copy". It says B6 right now. Well, that's the rent, so that must be OK. I guess I just hit enter. **(do so)**. Now it says range to copy to. Well, that's the rest of this row. **(Look at notes)**. OK, yeah, that's this anchor range thing. OK. So, **(reads)** I move over to the next cell **(do that, then look down at notes)**, then I hit period **(do that too, then read again)**. OK. right, now the range has a beginning and an ending, but they are both the same. So, now I move over to the last cell. **(start moving over)** Oh, I see, it all gets highlighted now. Neat. Then, when I get there, I hit enter again. **(do so)**. It worked!!

OK, I want to try another one. So, now I do food. OK that's 362. So, I type that into the right place. OK. Now **(look down quickly)** I get the menu **(type slash)** and then I get copy **(highlight and select copy)**. Now, range to copy from...it says B7 **(looking at screen)**. Yep, that's right. OK. So I hit enter. Now, range to copy to...It says B7 **(looking at screen again)** right now, but that's not right. OK, so I move over one place. Now it says C7, and that's the first part. So, I have to...**(look**

down)...that's right, I push period. And now I move over to the end. There. That's right. So, I hit enter. All right. **(continue entering the next cells)**

There. They're all done. Now I have to enter the total expenses for each month. **(read a bit)** Right. So I have to make a formula. Hmm. Let's see. It has to add up all of these cells **(pointing at screen)**. They are B6 to...B14. OK. So, now **(reads, flip pages)** Here it is. I want to make a sum. So, I type the at sign thing to say its a formula. That's **(look at keys)** here. Shift 2. OK **(Type that)**. Now I type SUM...and then a bracket...and the cells to add up...that's B6 and then two dots...and B14...now I close the brackets...and hit enter. Hey, that's it! OK. So now I have to do that for all these others. **(Reads)** Oh, no..I don't have to...I can just copy this too. OK **(now go through the copy function again)** That works really well.

Now, I have to get the balance. That's wages minus expenses. **(Reads)** That's this other kind of formula here, where I just do plus and minus. OK. So. I better move over here. **(Move to cell B18)**. OK. Now, it's the plus sign..because that says its a formula. right, and it's a different kind of formula than before, so it starts differently. OK. Now it's B4 minus...uh, where's the minus sign...oh there **(type minus)**. OK. Now minus B16. **(type B16 & enter)**. OK. There it is. Now, I guess I have to copy this across again. So, **(etc. to copy the formula across again)**.

Great. Oh. I forgot the row totals. I guess I'd better put those in too. OK. **(goes and puts them in)** There, done. Now I want to print it. **(flip pages)** Here it is. Print. OK. I get the menu. **(read)** Then I choose print...oh yeah, there it is. Then **(reads)** printer. OK. That makes sense. Now what? **(reads)** Now I have to say the range. I choose range **(do that)**. Now it says range is **(whatever cell you're in)**. **(read)**. Oh, this is just like before when I was copying. I just have to show the computer the whole area. I guess I should move to A1 first, so...how do I..oh yeah, that was Home. **(hit home)** There back to A1. So, now I hit period to anchor it. Then move all the way down to the end **(start moving)**, like that. Now I hit enter...**(read)** Oh, and now Go, so that it actually starts. **(printer starts going)** Hey, it worked! I did it! **(read some more)** Now I have to get out of this menu. I choose Quit. There.

(printer finishes) Well, that's pretty neat. Because really, it's only a couple of things to remember. The menu is right there. And you just type the things into the cells. And you don't even have to type that much because you can just copy everything. Actually, I'm surprised how much I've learned. This is really interesting. **(pause)** OK. What am I supposed to do next here. **(looks down at notes) (CAMERA FADE)**

Script #4: Lotus 1-2-3 (female)

- dropped after pretest

(Start out with your hands in your lap. Sit, and stare at the machine a bit. Then look down at the notes. Then up at the computer again)

OK. Well, I guess this is it. **(long pause)** I can't believe I'm so nervous. I should be able to do this. But **(trails off)** Oh, well. Nothing to do but try it, **(look at the camera)**. Right? Right!

OK. Here we go. **(read notes a bit)** Start Lotus. "At the D O S..oh yeah..that's "DOS"...prompt, type 123 and enter" OK. The DOS prompt is that C colon thing at the top of the screen... Umm. So, I type 1 2 3 **(type each one as you go)**. Then I hit enter. Now, where is that enter key. Oh. There it is. OK.

Here's the screen. OK. **(reading)** This is a window. The name of the current cell is in the top left corner. Oh yeah, there I see it. And it says READY in the other corner. Right.

If I wanted the menu, I type...what was it...oh yeah, it's the slash key. (looks for it) Here it is, with the question mark on it too. OK. **(tentatively, touch the key)**. There it is. Now, what are all of these things. **(reads)**

I see. The first line is the menu choices. The second line tells you about the choice that's highlighted. So, worksheet is highlighted, and below that is says "global, insert, delete... That must be the menu under worksheet. **(pause)** Now, if I want to see another one...say...copy...uh...**(reads)**..oh yeah, I move over with the arrows so that copy is highlighted **(do that)**...I see, it says "copy a cell or a range of cells". **(Move around in the menu and look at the choices) {ad lib. I wonder what that does...Oh, that must be...}** Here's Quit. It says End 123. **(pause)** Oh yeah, so that's what I do when I'm done.

OK, so that's the menu. Now, if I want to get out...**(read)** that's right, I escape...I always liked that - that's about how I feel...escape. **(hit esc to exit)**

Well, I guess I should try some of these exercises. Umm. Where is that table I'm supposed to enter. Oh, here it is...**(pull the table out of the binder)**. So. I guess each of these things goes in its own cell. **(pause)** Yeah.

OK. So I'll start with the first column. That's the titles. I guess I should move down 1 space. **(move to A2 with the arrow key)** Now, do I just type it in? **(type it, then watch the screen for a bit)** Well, there it is up there, but isn't it supposed to be down under A2... **(pause...look at notes)** Oh, of course, I have to hit enter **(hit enter)** Stupid. There it is now. OK. So now I do the next one. **(keep going**

down the column of headings). There. That's one column done. Now I go back up to B1 to do the next column **(move with arrows up to cell B1)**

Now, the next column is for January. OK. I type in Jan **(type that)** Oh, but it's supposed to be in capital letters. Now I'll have to go back...um **(read)**...right, I need the backspace key...found it **(backspace twice and retype the A N in capitals & enter)**. There. Much better. OK. Now I type in 2000 **(start typing it in...CAMERA FADE...return when starting last column - after the title JUN)** OK. Almost done. **(getting faster in typing...finish the column)** There.

Hmm. Now I'm supposed to put the totals in here in the next column. So I go up to the top **(move to cell G1)** Well, I can get the title all right **(type the column title)**...but I'm not sure about these totals. **(read)** Oh, yeah, now I remember...you tell it a formula. **(aside)** It's funny, I always forget to read things. I get in such a panic and then I screw up, but if I just read it first, it's not so hard.

OK. So, it starts with the funny a thing **(reads)** the "at sign". OK. **(read)**...and that tells Lotus that this is a function **(reads)**...a special kind of formula. All right. **(type @)** Then I type sum, **(type sum)** since I want it to add them up. and then a bracket...oh where's...there it is, on the 9 **[type (]**. Now, **(reads)** what cells do I want it to add...**(point to screen)** b2 **(type b2)** over to g2 **(type g2)**...oh wait, I forgot to put in the dots...**(backspace twice to erase the g2, then type two dots .. and then type g2 again & enter ... the computer beeps)**

Oh. It beeped at me. I guess I goofed. **(stare at the formula, check the notes, look back at the formula)** I forgot to put the other end of the bracket in. **(put in close bracket, & enter)** There. Look, it worked too!

Now, do I have to type that all the way down...**(reads)**...oh that's right! I forgot! I can copy those things. OK Let's try this...boy am I getting brave...**(put hands up to the keyboard to start typing, then stop)**

Wait a minute. Before I rush into this, I'm going to read the instructions all the way through...that way, I won't get into so much trouble. **(reads for a bit)**

OK. I think I get it. Let's go. Umm. First I get the menu. **(type /)**. There. Next I type...no, wait...I move over with the arrows to choose copy. **(choose copy)**. OK. Now it says Enter range to copy from...and it says H2..H2 - yep that's right. OK, so if that's what I want I hit enter **(hit enter)**. There. Now it says Enter range to copy to. **(look at notes)** It says here that I'm supposed to point to the range. Hmm. **(stare at it, check the notes again)**...Well, <u>the computer</u> says H2, but I don't think that's right. I want to copy into H5 and the rest of the rows, so I'm just going to try moving down here. **(move down 1 row)** There. Now it's in H5. OK, **(look back to notes)** Next, it says I have to anchor this range. So I put a period..oh, there's 2 of them **(pause)** oh yeah, that's right. And now I move down to the end of the rows. **(start moving)** Yeah, they're all highlighted now. That's right. OK. So, now I hit enter? **(Check notes)** Right. **(hit enter)** And there they are! All added up.

What's next? **(read notes)** OK. I have to add up the columns too. Hmm. Now how do I do this again? **(flip through notes)** Oh yeah. I have to put a formula, with the at sign and everything. **(move over to the cell below column B, and type the formula, referring often to the notes...@sum(b5..b13)...then enter)** There. Now, I guess I want to copy it over here...**(so, type /, then choose copy, then hit enter, then move over 1 cell, push period, then move to end of columns, then hit enter again)** Right again. Hey, I'm getting good at this.

Now, I just have to put this balance stuff in. **(start flipping through the notes...I think we'll cut the tape here)**

APPENDIX K

SUBJECT RECRUITMENT ADVERTISEMENTS

- MAIN STUDY -

Advertisements for Subjects
- Main Study -

I. Display Ad Placed in Business Section of Local Newspaper

MICROCOMPUTER TRAINING

Managers and professionals with an interest in learning WordPerfect and Lotus 1-2-3 are invited to participate in a two day training course at the University of Western Ontario.

The cost of the course is being subsidized as part of a research project. Participant Fee: $50

For further information please contact Debbie Compeau (679-2111 ext. 4544).

II. Ad Run on Local Radio Station

If you're lost when it comes to Lotus 1-2-3. If you're worried by WordPerfect, then U.W.O.'s Computer Learning Study program is for you. All managers and professionals are invited to enrol in this two day, intensive course, that unlocks the secrets of WordPerfect and Lotus 1-2-3. You'll receive hands on training, in small classes taught by a professional instructor.

This is a university subsidized computer program that costs only 50 dollars. So enrol today by calling Debbie Compeau at 679-2111, extension 4544.

APPENDIX L

TOPICS COVERED
IN
DAY 1 CONCEPTS SESSION

Introduction to Computers and DOS

- Components of a computer
  monitor, keyboard, system unit, diskette drives

- The Keyboard
  comparisons to typewriter keyboard, plus additional keys (e.g., CTRL, ALT, backslash)

- The Monitor
  on/off switch, brightness controls

- Communicating with your PC
  Computer language (binary), operating system, software

- Diskettes, Hard Disk, Directories
  Care & handling of floppy disks

- Files & File naming conventions

- Simple DOS commands
  DIR, COPY, ERASE
  Starting applications software

APPENDIX M

TRAINING NOTES

- MAIN STUDY -

COMPUTER LEARNING STUDY

INTRODUCTION TO MICROCOMPUTERS
and
THE DISK OPERATING SYSTEM (DOS)

School of Business Administration
The University of Western Ontario

1991

OVERVIEW

Before we begin to learn WordPerfect 5.1 or Lotus 1-2-3, it may be helpful to review a few concepts about microcomputers and DOS.

The microcomputers you are using are IBM PC-AT computers (or clones of the PC-AT). The computers are linked together in a network. There is a floppy disk drive (the A drive) where you can store your data. In order to use these machines, it is necessary to connect to the network, or LOGIN.

The computers in the lab are always left turned on. All you will need to do is turn on the monitor. You will see a screen with the Business School Computing Lab logo, and a prompt at the bottom of the screen telling you to login.

Type the following command: **login userid** (your userid will be assigned by the instructor). A small program executes to connect you to the network and to scan your diskettes for viruses. Once this program is complete, the D:\> prompt will appear on your screen. You are now logged in and ready to begin.

DOS

Every computer needs a special kind of program called an operating system to make it easier to use. The operating system acts as a sort of translator between you and the computer. Commands that you enter are translated into the language that the computer understands.

The operating system used on most IBM (and compatible) computers is called the Disk Operating System or DOS. You can use DOS to do many things, including copy files, see what is on your floppy diskette, and start other applications (e.g., WordPerfect, Lotus 1-2-3). For today's session, we will only use DOS to start our applications.

THE KEYBOARD

The keyboard looks something like the keys on a typewriter, but there are a number of extra keys.

Across the top of the keyboard are 10 function keys (labelled F1 to F10). The function keys are used to access common features of software packages. They are used differently in each package. Other keys that you should know about are:

SHIFT KEY	Used to type capital letters and the symbols displayed on the top half of the keys (if there are any).
CAPS LOCK KEY	When pressed once, capital letters are typed. Symbols and numbers are not affected. When pressed again, small letters are typed. A light in the top right corner of the keyboard indicates whether CAPS LOCK is on or off.
ALT KEY	Stands for Alternate Key. Used in combination with other keys (e.g., the function keys) to access different features.
CTRL KEY	Stands for Control Key. Used in combination with other keys (e.g., the function keys to access different keys.
NUM LOCK KEY	Works like the caps lock key. When turned on, pressing the keys on the number pad types the numbers. When turned off, the keys on the number pad have other functions (named on the bottom half of the keys).
ARROW KEYS	Move the cursor up, down, left and right.
PGUP, PGDN	Used to move up and down in larger increments (e.g., pages). Specific function depends on the software package.
HOME, END	Also used in cursor movement. Specific function is different for different software packages.
INS, DEL	The INSERT and DELETE keys are used in editing to make it easier to add and delete characters. Their specific function depends on the software package.

COMPUTER LEARNING STUDY

INTRODUCTION TO SPREADSHEETS

with

LOTUS 1-2-3

School of Business Administration
The University of Western Ontario

1991

OVERVIEW

What is Lotus 1-2-3?

Lotus 1-2-3 (Lotus) is a popular software package for financial analysis. Lotus spreadsheets can be used for budgeting, analyzing trends, creating graphs, sorting data, statistical analysis, and a variety of other tasks. It is a powerful package which can be tailored to suit specific applications.

A Lotus spreadsheet is a rectangular grid of columns and rows. Information (either text or numbers) is entered in cells (a cell in the intersection of a column and a row). This information is then manipulated using Lotus. For instance, a column or row of names can be sorted alphabetically. Numbers can be summed and averaged. Complex mathematical formulae can be applied to manipulate the data.

While Lotus is a very powerful tool, it is relatively easy to learn. Only a few basic commands are needed for simple applications. Once you have mastered these, you can learn additional features by experimentation. A help feature is built in to Lotus to assist you in using unfamiliar functions. Moreover, since Lotus is so popular, a variety of books are available to help you learn.

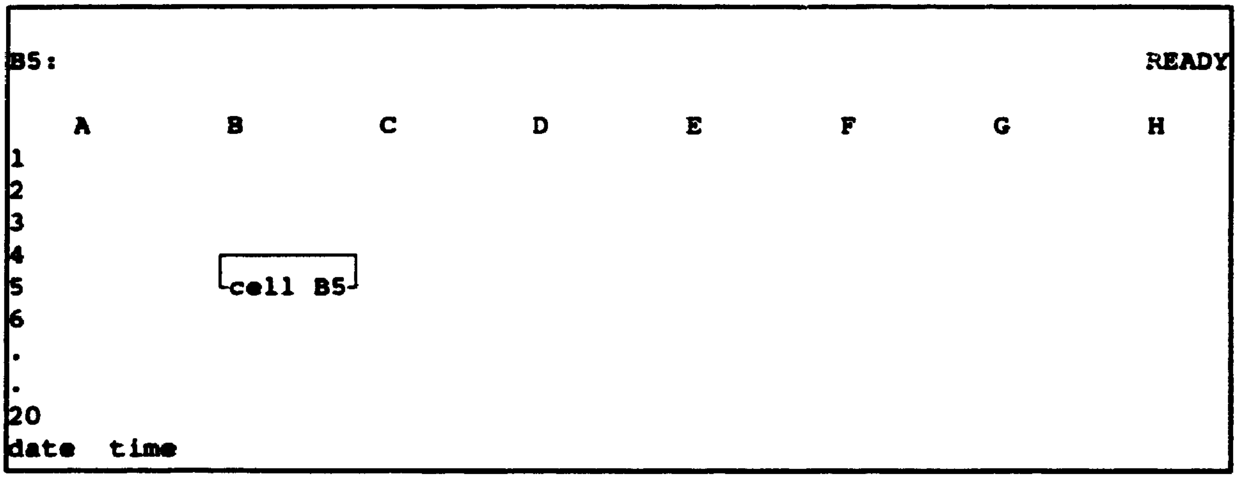
We will work through a number of exercises to try out some of the main features of Lotus. Throughout these notes, the keystrokes that you actually type will be in **boldface type**. The symbol <enter> means to hit the enter key.

STARTING LOTUS

At the DOS prompt (e.g., D:\> or C:\>)...

Type **123 <enter>** (Remember that <enter> means to hit the enter key)

After a moment, the worksheet appears. A screen approximating that shown below will display.



```
B5:                                                              READY

    A        B        C        D        E        F        G        H
1
2
3
4
5         cell B5
6
.
.
20
date  time
```

This is a "window". It consists of 8 columns (A to H) and 20 rows. Each column is 9 characters wide. The intersection of a row and column is called a cell. Cell B5, then, is the intersection of column B with row 5. B5 is called the cell address. A cell pointer highlights the current cell. The address of the current cell is shown in the upper left corner of the screen.

The "mode indicator" is in the upper right hand corner of the screen. When the indicator says READY, you can enter information into the cells of the spreadsheet. In MENU mode, you can make choices from the Lotus menu. In POINT mode, you move the cell pointer to point to particular cells. (We'll talk more about MENU and POINT modes later).

ENTERING LABELS

The first step in entering a spreadsheet is to enter the labels for the columns and rows. Move the cell pointer to the cell in which you want a label and type the label. As you type, notice that the text does not immediately appear in the cell. It is typed at the top of the screen, below the cell address. When you hit the enter key, the text appears in the proper cell.

When entering labels, it is necessary to tell Lotus that what you are typing is a label, and not a formula or data. In order to do this, all labels must begin with a label prefix.

There are 3 different label prefixes in Lotus, ', ", and ^. All 3 of these symbols tell Lotus that what follows is a label. In addition, they tell Lotus where to position the label within the cell.

' The ' (single quote) label prefix tells Lotus to align the text with the left hand side of the cell.

" The " (double quote) label prefix tells Lotus to align the text with the right hand side of the cell.

^ The ^ (Shift 6) label prefix tells Lotus to centre the text in the cell.

While all labels must begin with a label prefix, it is not always necessary to enter the prefix. Labels that consist entirely of alphabetical characters are automatically interpreted by Lotus to be labels. If no label prefix is typed before this kind of label, the single quote prefix is assumed.

ENTERING DATA

Once your column and row titles are set up, you are ready to enter data into the spreadsheet. Move the cell pointer to the cell where you want to enter data, and type the entry. Again, notice that the entry does not appear immediately in the cell. It is typed at the top of the screen below the cell address and will be entered into the cell when you hit the enter key.

When entering data, you cannot insert a label prefix to align the characters in the cell. If you do this, Lotus will interpret the entry as a label and you will not be able to perform mathematical operations on the data.

Correcting Errors

If you make a mistake while entering information into a spreadsheet, position your cell pointer in the cell to be changed, and choose **F2** (Function Key 2 - Edit). Now you are in EDIT mode and you can change the entry. The BACKSPACE key deletes the character immediately before the cursor. The DELETE key deletes the character the cursor is on.

As an alternative, you can just retype the entry and Lotus will replace the incorrect version with what you type.

MOVING AROUND THE SPREADSHEET

A number of keys are used to move around the spreadsheet quickly. A summary of the main keys and their function follows:

ARROW KEYS	Move the cell pointer one cell in the indicated direction.
HOME	Moves the cell pointer to cell A1.
END HOME	End key followed by the home key. Takes you to the last cell entry in your spreadsheet.
PG UP	Moves the screen up 20 lines.
PG DOWN	Moves the screen down 20 lines.
CTRL-ARROW	Moves the screen 80 characters to the left or right.
END ARROW	End followed by an arrow key will move the cell pointer to the next beginning or end boundary of your data.
NUM LOCK	Allows the number pad to be used for entering numbers.
F5	Function key F5 is the GOTO key in Lotus. It will prompt you to enter a cell address. The cell pointer will then be moved to that address (e.g., pressing **F5** and then responding **G22** will move the cell pointer to column G, row 22).

USING THE MENUS

The / (slash) key is the most important key in Lotus 1-2-3. Pressing this key accesses the Lotus menus. The menu appears across the top of the screen. Underneath the row of menu choices is a list of subcommands that are accessed by selecting the highlighted choice. To select commands from the menu, use the arrow keys to move left or right until your choice is highlighted. Then select enter.

If you want to get out of a menu, hit the esc (escape) key. You will be returned to the next higher level menu (or to READY mode). Keep hitting esc until you are in READY mode.

We will talk more about using the menus when we look at specific commands. For now, remember how to access the menus (the / key) and how to "back out" of the menu (the esc key).

ERASING ENTRIES

If you want to erase an entry from a cell, move to that cell, and press the **SPACEBAR.** Then hit **<enter>**. The old entry has been replaced by a single space. If you want to erase the entries in many cells, select RANGE followed by ERASE from the Lotus menu.

You will be prompted to enter the cell addresses of the starting and ending cell in the range. You can either type in the range (e.g., B19..J20 - this would erase all of the entries in the rectangular area from column B to column J and row 19 to row 20), or you can point to the range (see instructions for Pointing to a Range under the Copy Command).

COPY COMMAND

Often in creating spreadsheets, a great deal of the data is repeated across columns or rows. Rather than entering the same numbers over and over again, we can enter the value once, and copy it into the rest of the cells.

Start by entering the first value.

Position your cell pointer in the cell containing the data to be copied. Now access the Lotus menu by typing / (slash). Select COPY from the menu. You will be asked to indicate the range you want to copy from. This is asking you to indicate what it is you want copied.

Point to the range you want to copy from (see the section on **Pointing to a Range**). Once the correct range is indicated in the menu area (and highlighted on the screen) hit **<enter>**.

Next you will be asked to indicate the range you wish to copy to. To point to this range, move the cell pointer to the first cell and press . (period) to anchor the range. Now move the cell pointer to the last cell and hit <enter>. The values will be copied.

Pointing to a Range

Many Lotus operations require that you use the cell pointer to point to ranges of cells (e.g., in Copy, Move, Range Erase, Range Format).

Pointing to a range means indicating to Lotus the beginning and ending cells of the range. Whenever you are required to do this a prompt will appear at the top of the screen (in the command area). For example, in the copy command the prompt "Enter range to copy FROM:" will appear, along with an address.

If only one cell is specified in the address (e.g., Enter range to copy FROM: A3) then you are ready to point to the beginning cell. Move the cell pointer to the first cell (e.g., B19). The address in the prompt will change to reflect the position of the cell pointer.

When two cells are specified in the address (e.g., Enter range to copy FROM: B19..B19 or Enter range to copy FROM: B19..B21) then you are ready to point to the ending cell. If you have not yet defined the beginning range (e.g., in the examples, if A3 was not the right beginning cell) you would have to "unanchor the range" by pressing the ESC key.

Once you have correctly set the beginning cell, press . (period) to anchor one corner of the range. When you press the period key you are telling Lotus that the starting cell is OK and you are ready to point to the ending cell. The range indicated in the command area now has both a beginning and ending address, both the same (e.g., B19..B19).

Now you are ready to move your cell pointer to the last cell in the range (e.g., J20). As you move a rectangular area will be highlighted to indicate the size of the range, and the range in the menu area will indicate the starting and ending cells (e.g., B19..J20).

Once you have pointed to the entire range and it is highlighted on your screen, hit <enter> to tell Lotus that you are ready to go on.

Copying Formulae

Formulae can be copied in the same manner as values. When a formula is copied, however, the cell addresses are adjusted so that the formula works on the cells in the same position relative to the current cell.

For instance, if a formula in cell H2, @SUM(B2..G2), was copied into cell H5 the copied version would actually read @SUM(B5..H5).

MOVE COMMAND

This command, MOVE from the menu, works the same way as copy. Point to the range you want to move from, hit **<enter>**, then point to the range you want to move to.

FORMATTING A RANGE

Ranges in Lotus spreadsheets can be formatted in a variety of different ways. This formatting affects the way the entries look on the screen, but do not affect the operation of Lotus. For example, cells containing dollar amounts can be formatted as currency. To do this, we select RANGE, FORMAT from the menu, select the type of format we want (currency) and then point to the range we want defined as currency (as we did for erasing and copying).

Other useful formats are: scientific notation, fixed number of decimal places, and commas inserted to break up thousands.

You can also define a format for every numeric cell in the spreadsheet by selecting WORKSHEET, GLOBAL, FORMAT and then choosing the desired format.

SETTING COLUMN WIDTHS

To change the width of every column in the spreadsheet (the default width is 9 characters), select WORKSHEET, GLOBAL, COLUMN-WIDTH from the menu, and then enter the desired width (e.g, **15 <enter>**).

To change the width of a single column, position the cell pointer in any cell of the appropriate column. Select WORKSHEET, COLUMN, SET-WIDTH from the menu, and then enter the desired width.

INSERTING COLUMNS OR ROWS

Position the cell pointer in the column immediately to the right (for columns) or below (for rows) the place where you want a new column inserted.

Select WORKSHEET, INSERT, COLUMN (or ROW) and hit **<enter>** and the new column is added. Notice how the other columns or rows shift to make room for the addition.

DELETING COLUMNS OR ROWS

Position the cell pointer in the row or column to be deleted. Select WORKSHEET, DELETE, ROW (or COLUMN), and hit **<enter>** and the row or column will be gone.

SAVING A FILE

Once you have created a spreadsheet, you may want to save it for future reference. To save a file, you must first access the Lotus menu.

Type / (slash) to access the menu. Now choose FILE from this menu. Use the arrow keys to highlight the word file, then press enter. (You can also type the first letter of any menu item to access it). Next, choose SAVE from the menu.

You will be prompted to enter a file name. The file name can be up to 8 characters in length. Once you have typed the name, press **<enter>**. Lotus will automatically add the extension .WK1 to your file name.

If a spreadsheet with the same name as you chose already exists, you will be asked if you want to REPLACE the stored version with your spreadsheet, or CANCEL the command.

ERASING A SPREADSHEET

Once you have created a spreadsheet and saved it, you may want to clear the spreadsheet from the screen to work on something else. Erasing the spreadsheet does not affect the copy that you saved on your disk.

To erase the spreadsheet, first access the Lotus menu. Now select WORKSHEET from the menu. Then select ERASE to indicate that you want to erase the current worksheet from Lotus' memory. Next you will be asked to confirm that you want to erase it. Choose YES and the spreadsheet will be cleared. Choose NO and you will return to the READY mode.

RETRIEVING AN EXISTING FILE

If you want to make changes to a spreadsheet that you have already saved, you must retrieve the file into Lotus.

Access the Lotus menu. Now select FILE from the menu. Next, select RETRIEVE. A listing of the files stored on your disk will appear where the menu was. Move to highlight the file you want to retrieve and hit **<enter>**. In a few seconds, the spreadsheet will appear on your screen.

FORMULAE AND FUNCTIONS

When creating a spreadsheet, we can get Lotus to add up the columns and rows (and do any other arithmetic required). For instance, to get Lotus to add up a series of cells, you can enter a formula like the following:

+B2+C2+D2+E2+F2+G2

The result will appear in the cell where the formula is entered.

Formulae always start with a plus sign. This tells Lotus that what follows is a mathematical operation and not a label. The plus (+) and minus (-) keys are fairly obvious on the keyboard. The symbols for multiplication and division are a bit less clear. Multiplication is accomplished using the * (SHIFT 8) symbol and division is accomplished using the / (slash) symbol.

Some very common formulae have been set up as FUNCTIONS in Lotus. For instance, instead of typing the formula above, we could have used the SUM function. Functions always begin with the @ sign (SHIFT 2) to indicate that what follows is a function.

@SUM(B2..G2)

This tells Lotus to add up all of the entries in cells B2 up to and including G2, and to place the result in the current cell. A list of FUNCTIONS can be found in the help facility (choose **F1** to get into HELP).

PRINTING A SPREADSHEET

Move your cell pointer to cell A1. Select PRINT from the menu. You will be asked whether you want to print to the printer or to a file (if you print to a file, you can retrieve the data into a package such as WordPerfect). Choose PRINTER to get a hard copy of your spreadsheet.

Now you will be asked to indicate the range you want printed. Point to the range (if you started in cell A1, press . to anchor the top corner, then hit **END HOME** to move to the last cell entry, then hit **<enter>** to accept the range).

Now make sure that the paper in the printer is positioned at the top of a page, and select ALIGN. Then choose GO. You will be returned to the Print menu. Choose QUIT (or hit ESC several times) to get back to READY mode.

LEAVING LOTUS 1-2-3

When you are ready to leave Lotus, access the menu (type /). Choose QUIT from the menu. You will be asked to confirm that you really want to quit. Select YES to exit Lotus, NO to return to the spreadsheet.

CREATING GRAPHS

Lotus 1-2-3 includes a facility for creating and printing graphs of various entries in the spreadsheet. Graphs are relatively simple to create and can be a very useful tool in presenting your analyses. To create a graph in Lotus, start with a completed spreadsheet in the work area.

Select GRAPH from the menu. You will now see a submenu of the different options for creating and working with Lotus Graphs. The menu choices are as follows:

Type, X, A, B, C, D, E, F, Reset, View, Save, Options, Name, Quit.

Each of these menu items will be discussed below.

TYPE This option allows you to choose different types of graphs to create. If you select TYPE from the menu, you will be given the following choices: Line, Bar, XY Stacked-Bar, Pie. Try out each of them to see what they look like. Once you select a choice from this menu, you will be returned to the Graphing menu.

X This option lets you define the X-range (or horizontal axis) for your graph. When you select X from the menu, Lotus asks you to point to the range. Sometimes you can use column or row headings as the x-range. For example, if you have data for a number of years, and you want to graph the information over time, you would choose the years as the x-range.

A-F	Choices A, B, C, D, E, F let you define the other data ranges (the horizontal axis) for your graph. For instance, if you were graphing financial information over a 5 year period, you might define sales as your A range, profits as your B range. You select these ranges by pointing to them on your graph.
RESET	This option allows you to cancel all of your graph settings for a spreadsheet.
VIEW	When you choose VIEW from the menu, Lotus will show you a picture of your graph on the screen. Once you have finished looking at your graph, hit any key to return to your worksheet screen.
SAVE	This choice allows you to save a picture of your graph in a file. You must do this if you want to print your graph later. You can also convert the file to a WordPerfect graphics file and bring it into a WordPerfect document.
OPTIONS	This choice gives you another menu of settings for Lotus graphs. You can use this menu to define a LEGEND for your graph (which tells you what the lines or bars represent), to give your graph a title and define the axes (TITLES) and to customize other aspects of your graph. Try out some of these options to see what they will do for you. Once you have set all of the options you want, choose QUIT to get out of this sub-menu.
NAME	The NAME command allows you to save the graph settings with your worksheet. This is not the same as saving a graph to a file. What it does is assign a name to the various settings you have defined for a graph. Then, you don't have to recreate the graph every time you want to see it.
QUIT	This option lets you quit from the graph menu.

COMPUTER LEARNING STUDY

INTRODUCTION TO WORD PROCESSING

with

WordPerfect 5.1

School of Business Administration
The University of Western Ontario

1991

OVERVIEW

What is word processing?

A word processing package is a particular kind of computer application with special features to handle written material. Word processing is more than just computer based typing. With a typewriter, the words are put immediately to paper. Thus, in order to make changes to a page that was already typed, you would have to retype the entire page. In word processing, documents are stored electronically, and can be edited easily.

In the editing process, a number of special features make the task easier. Words can be automatically "searched and replaced." Blocks of text can be "cut and pasted" electronically, rather than retyped. An electronic dictionary assists in checking that words are spelled correctly.

What is WordPerfect 5.1?

WordPerfect 5.1 is a powerful tool for word processing. It is rapidly becoming the standard choice for businesses. Version 5.1 is the most recent release of WordPerfect, and incorporates the latest features. Other versions still available include 4.2 and 5.0.

In spite of the power of WordPerfect, it is easy to learn. Special features are accessed using the function keys, or with a simple menu. A help feature is built into WordPerfect to assist in using unfamiliar features.

We will work through a number of exercises to try out some of the main features of WordPerfect. Throughout the notes, the keystrokes that you actually type will be in **boldface type**. The symbol <enter> means to hit the enter key.

STARTING WordPerfect

At the DOS prompt (e.g., D:\> or C:\>)...

Type **wp <enter>** (Remember that <enter> means hit the enter key).

After a moment, the editing screen appears.

The editing screen represents a blank page. The bottom line of the screen is called the "Status Line." It tells you a number of things:

Document Name:	Once you have saved a document the name you gave it will appear in the lower left hand corner of the page.
Document Number:	In WordPerfect, you can work on two documents at once. The document number (e.g., Doc 1 or Doc 2) indicates which of those documents you are currently editing.
Page Number:	New pages are automatically started when a page is full. The page number tells you the number of the current page.
Cursor Position:	The rest of the status line tells you the position of the cursor on the page. The line is indicated in inches from the top of the page (e.g., Ln 1" means 1 inch from the top of the page). The distance from the left side of the page is indicated as Pos (e.g., Pos 1" means 1" from the left hand side of the page).

Occasionally, the information on the status line will be replaced by error messages or prompts.

BASIC TYPING

Using WordPerfect is as simple as hitting the keys on the keyboard. Most of the formatting is done automatically by the program.

As you type, the cursor position changes. The Pos indicator increases as you move further from the left side of the page. The program automatically starts a new line when it runs out of room. This is called "word wrap." When a new line is started, the Pos indicator starts over at 1", and the Ln indicator increases (since you are now further from the top of the page).

If you want to end a line before it is full (e.g., the end of paragraph) hit the enter key to start a new line. Hitting **<enter>** at the beginning of a line will give you a blank line.

CORRECTING MISTAKES

Deleting Incorrect Text

There are several ways to make corrections using WordPerfect. The Backspace key erases the character immediately before the cursor. The Delete key erases the character the cursor is on.

Try each of these keys to see how they work.

Inserting New Text

Sometimes it is necessary to insert a word in the middle of existing text. To do this in WordPerfect, just move the cursor to the place you want the text to go and start typing. The words to the right of the cursor shift sideways to make room for the new text. This is because WordPerfect is in INSERT mode.

If you hit the Insert key, WordPerfect switches to TYPEOVER mode. Notice that the word "Typeover" appears on the status line in the bottom left hand corner of the screen. Now if you start to type in the middle of existing text, the words to the right of the cursor will be deleted as you type over them.

If you hit the Insert key again, WordPerfect switches back to insert mode. It is usually best to work in insert mode.

CURSOR MOVEMENT KEYS

A number of different keys are available to move around in a document. The following list indicates each of the keys (or combinations of keys) and summarizes their function:

ARROW KEYS	Move the cursor one character to the left, to the right, up or down.
CTRL-LEFT	Moves one word to the left.
CTRL-RIGHT	Moves one word to the right (hold down the control key while you hit the arrow key).
HOME LEFT	Moves to the beginning of the line.
HOME RIGHT	Moves to the end of the line.
END	Moves to the end of the line.
HOME HOME UP	Moves to the beginning of the document.
HOME HOME DWN	Moves to the end of the document (hit the home key followed by the arrow keys).
CTRL-HOME	Go To: type a character to go to the first occurrence of that character Go To: type the number to go to a specific page Go To Go To: Ctrl-Home twice will return you to your previous position if you accidentally use the wrong cursor movement keys.
- +	Hitting the minus key on the number pad moves you backward one screen in your document, hitting the plus key on the number pad moves you one screen forward in your document. (The minus and plus keys in the regular typing area of the keyboard cannot be used for screen up/down).
PAGE UP	Moves the cursor to the first line of the previous page.
PAGE DOWN	Moves the cursor to the first line of the next page.

ENHANCING TEXT

Centering a Title

If you want to centre a title between the left and right margins, choose **SHIFT-F6** (Centre) and then enter the text. Hit <enter> when you are finished.

Bold

To enter new text in boldface:

> Choose **F6** (Bold) and type the text you want to be bold. When you have entered the text, choose **F6** again to turn the bolding off.

To add boldface to existing text:

> If you have already typed a word (or words) and you decide you want them to be boldfaced, you must first block the text and then choose bold.
>
> Position your cursor at the beginning of the text you want bold. Choose **ALT-F4** (Block), then move your cursor to the end of the block. When all of the text that you want to be bold is highlighted, choose **F6**. The text is now bold.

Underscore

To underline new text, choose **F8**, then type the text, then choose **F8** again.

To underline existing text, first block the text using **ALT-F4** (as described for boldface) then choose **F8**.

ENDING PAGES

There are two different kinds of page ends (or page breaks) in WordPerfect. The first kind is inserted automatically when a page becomes full. This is called a "soft" page end, and will continue to adjust as you make corrections and edit the document. A soft page end is represented by a single line across the editing screen.

The second type of page end is called a "hard" page end. You can insert a hard page anywhere in your document that you want to start a new page. For instance, you might want to begin a new section of a report on a new page, regardless of whether the previous page was full. To do this, you use a hard page end. A hard page end is represented by a double line across the editing screen. To insert a hard page end type **CTRL-<ENTER>** (press and hold the control key while pressing the enter key).

MOVING A BLOCK OF TEXT

Sometimes when editing a document, you will find that a particular piece of text (e.g., a phrase, a sentence, a paragraph, several pages) needs to be moved to a different place in the document. Rather than deleting the text in one place and retyping it somewhere else, you can use WordPerfect to move it.

First move to the first character of the text you want to move. Choose **ALT-F4** (Block). Move the cursor to the last character of the text. Notice that the text is highlighted, and the words "Block on" are flashing at the bottom of the screen.

Now choose **CTRL-F4** (Move) to indicate to WordPerfect that you want to move the highlighted text.

A menu will appear across the bottom of the screen asking whether you want to move a block, a column, or a rectangle. Choose 1 (Block) to indicate that you want to move a block.

Another menu will appear across the bottom of the screen. This menu asks whether you want to move, copy, append or delete. Since we are trying to move the text, choose 1 (Move). The highlighted text will disappear from the screen.

The following prompt will now appear at the bottom of the screen: "Move cursor; press enter to retrieve". WordPerfect is asking you to tell it where you want to move the block to. Move the cursor to the location where you want the text to go, and press enter. The text has now been moved.

CHANGING THE FORMAT OF A DOCUMENT

WordPerfect is set up with certain default formats. Every time you start WordPerfect, those formats will be in effect. For example, the top and bottom margins are automatically set to 1" and ". The left and right margins are also set to 1" and 1".

Most of the time, these default formats are just fine. Sometimes, however, you need to change them to suit a particular document. The Format menu **SHIFT-F8** helps you work through the formats to set them up as you prefer. If you change the format of a document in the middle, the format changes only apply to the text that follows the change.

Example

Suppose you wanted to change the left and right margins of the current document. You want to change the margins for the whole document.

Start by positioning the cursor at the very top of the document (use **HOME HOME UP** to take you there). Now choose **SHIFT-F8** to access the format menu. Here you have four choices about the kind of format changes you wish to make. Changing the left and right margins is part of the line format.

Choose **1** (Line) to access the line format menu. The menu that appears gives you several options to change. Since we want to change the margins, choose **7** (Margins).

Your cursor will now be positioned under the left margin setting. The current setting is 1". Type your choice to replace the default setting (e.g., **1.5 <enter>**). Now your cursor is positioned under the right margin setting. Again type your choice (e.g., **1.5 <enter>**). Now choose **F7** to exit the format menu. (If you want to cancel your changes, choose **F1**).

REVEAL CODES

The editing screen for WordPerfect shows only the text that you are entering, and not the formatting codes that will be used in printing (e.g., bold, centre, margins etc.). Sometimes it is necessary to see these codes, however, when you are trying to edit a document. In order to reveal the formatting codes, choose **ALT-F3** (Reveal Codes).

The editing screen is now divided in the middle by a highlighted bar. Above the bar is a smaller version of your normal editing screen. Below the highlighted bar, is the text with the formatting codes displayed too. "The cursor in the top screen (editing screen) is mirrored by a cursor in the bottom screen (Reveal Codes screen). The cursor in the Reveal Codes screen is normally a solid block that highlights each code or character as you move the cursor."[7]

By looking at the formatting codes in the Reveal Codes screen you can determine where to position your cursor to make your changes.

---

[7]. Wordperfect Workbook for IBM Personal Computers, p. 21.

SPELL CHECK

To check the spelling of your document, choose **CTRL-F2** (Spell). A menu appears at the bottom of the screen, asking if you want to check a single word, a page, or a document (among other things). Enter your choice (e.g., **3** to check the whole document).

The message *Please wait* will appear at the bottom of the screen while WordPerfect checks your document. If it finds a word it does not recognize, a split screen will appear. Your text will appear in the upper screen, with the incorrect word highlighted. In the lower screen, several alternate spellings will appear. Type the letter next to the correct choice to select one of these.

You can also tell WordPerfect to skip that word (either once or every time it appears in this document) if you don't wish to change it by selecting options **1** or **2** from the menu at the bottom of the screen. Alternatively, you can add the word to a permanent supplementary dictionary (choice **3**).

If no alternative spellings of the highlighted word appear, or if none of the choices is correct, you can edit the word from within the speller. Choose **4** to edit a word.

THESAURUS

WordPerfect contains a thesaurus (or list of similar words) to assist in writing. Position your cursor under the word you want to look up (e.g., similar). Then choose **ALT-F1** to access the thesaurus. A list of equivalent words will be displayed on the screen. You can look up any of these words by typing the letter next to it. Choose **F7** when you are ready to leave the thesaurus.

SAVING YOUR WORK

When you are finished working on a document, you may want to save it electronically. The saved version can then be called up later and edited, or simply stored as a reference should you ever need to see what you wrote. To save a document:

Choose **F10.** Function Key 10 is the save function.

A prompt will appear at the bottom of the screen saying "Document to Be saved:"

WordPerfect is asking you to enter a filename (remember that the filename can be up to 8 characters plus a period and a 3 character extension). Type in the name you want to give your document and then hit the enter key.

If a file with the name you have specified already exists (e.g., an older version of the same document) WordPerfect will tell you this, and give you the option to REPLACE the older version with your current working file, or to assign a new filename if you don't want to overwrite the old file. The prompt "Replace <whatever the filename is>?" Yes (No) will appear at the bottom of the screen. If you choose yes, the disk version will be replaced by the current working version of the document. If you choose no, you will again be prompted to enter the filename.

REVISING AN EXISTING FILE

When you want to call up a file that already exists so you can work on it, start by listing the files on your diskette:

Choose **F5** (List). WordPerfect will show the directory name in the bottom left hand corner (e.g., Dir A:*.*). Press **<enter>** to indicate that this is the correct directory.

Now you will see a listing of the files on your A disk. You should see the file that you just saved listed among them, as well as other files that I saved on your disk for you to work on. Beside each file name is a number indicating the size of the file (in bytes) and the date and time it was created. At the bottom of the screen is a menu, indicating all of the things you could do from this screen. Option 1 is Retrieve.

To retrieve a file position the cursor beside the correct file (the file information will be highlighted) and type **1** for Retrieve. In just a few seconds (longer for really big files) the text will appear on your screen. Now you are ready to edit the file.

PRINTING A DOCUMENT

Once you have created a document, and edited it until you are satisfied, you are ready to print it on paper. As a final step before printing, I recommend that you "preview" your documents. Previewing shows you on the screen exactly what the document will look like on paper.

Preview

Choose **SHIFT-F7** (Print). A menu appears with all of the options for printing. Number **6** in that menu is view document. Type **6** to choose this option. In a few seconds, you should see a "picture" of the current page of your document on the screen. Use **PAGE UP** and **PAGE DOWN** to move backwards and forwards through your document until you are satisfied that it looks OK. Press **F7** to exit from previewing. Now you are ready to print.

Printing

Choose **SHIFT-F7** (Print). Now choose **1** to print the full document. WordPerfect will now send your job to the printer. If you want to print just the current page, choose **2** from the print menu. Choosing **7** from the menu allows you to print several pages.

EXITING WordPerfect

When you are ready to leave WordPerfect, choose **F7**. Function Key 7 is the exit function. WordPerfect will ask you if you want to save your work. If you have not already done so, now is your last chance to save what you have done. Once you have saved the document (or indicated that you do not want to) the following prompt will appear at the bottom of the screen:

"Exit WordPerfect?" No (Yes)

Choose Yes to leave the system and return to DOS. Choose No to remain in WordPerfect with a clear workspace. If you choose this option your working copy of whatever you have been editing will be erased (the saved version will be unaffected). Choose **F1** (Cancel) to stay in WordPerfect without clearing the workspace.

APPENDIX N

PRACTICE EXERCISES

- MAIN STUDY -

COMPUTER LEARNING STUDY
Lotus 1-2-3 Exercises

1. This exercise will give you a chance to familiarize yourself with the basics of using Lotus 1-2-3. You will learn to retrieve a file, enter the data for a simple financial task (the bank reconciliation), use formulae to automate calculations, and save the altered worksheet.

(a) Start Lotus 1-2-3.

(b) The file BANKREC.WK1 is stored on your A disk. The file contains all of the headings you will need for the bank reconciliation. Load this file into the working memory (see RETRIEVING AN EXISTING FILE).

(c) Enter the final Balance from Statement of $2,798.76 and the Balance from Cheque Register of $3,499.96.

(d) A number of deposits/credits were made to the account following the statement. In order to enter these into the worksheet, you will have to add 5 rows. Follow the instructions under INSERTING COLUMNS OR ROWS to make room for your entries.

(e) Add the following dates and amounts into the new rows. Don't worry about the format of the amounts right now, we'll change that later.

01/31/91	$ 757.98
02/06/91	$ 146.80
02/09/91	$ 98.00
02/09/91	$3,300.00
02/15/91	$ 449.01

(f) A number of withdrawals/debits were also made after the statement. These also need to be entered into the worksheet. Again, you will have to add sufficient rows to hold them.

01/31/91	$2,211.88
02/01/91	$ 150.00
02/02/91	$ 87.99
02/03/91	$ 123.87
02/08/91	$ 997.54
02/10/91	$ 281.22
02/11/91	$ 45.44
02/13/91	$ 33.45
02/15/91	$ 119.20

(g) Compute the subtotals for the deposits and for the withdrawals. Use the SUM function (see FORMULAE AND FUNCTIONS) to calculate the totals.

(h) Compute the Adjusted Balance and the Difference using a simple formula (Hint: Adjusted Balance = Balance from Statement + Additional Deposits - Additional Withdrawals).

(i) Use the RANGE FORMAT (see notes) command to tell Lotus that the numerical amounts in the worksheet represent currency.

(j) Print the spreadsheet (see PRINTING A SPREADSHEET).

(k) Save the completed spreadsheet (see SAVING A FILE). Give it a new name, so that the shell (BANKREC.WK1) will be left unchanged. Remember that file names are 8 characters long and automatically have the extension .WK1 added to the end of them to indicate they are Lotus files.

(l) Exit Lotus 1-2-3.

2. In this exercise you will enter a relatively simple six month budget (shown in Figure 1). You will practice copying entries from one or more cells and computing totals using formulae.

   (a) Start by entering Lotus 1-2-3. Then, enter the column and row headings shown in the figure (position your cell pointer in the correct cell and type the entry in capital letters). Don't worry about the row headings overflowing into the next cell. We'll come back to fix that up later.

   (b) Now, enter the wages of 2000 per month in each of the 6 months.

   (c) Next, enter the rent of 475 in January, and copy the entry into the other months. Use the instructions under COPY COMMAND for assistance if you need it.

   (d) Now that you've copied a single cell, try to copy a range of cells. Start by entering the food and clothing expenses for January from the figure. Now, use the copy command to copy both expenses across the columns. (Hint: the only difference from copying one cell is the "range to copy from," which is now 2 cells.

(e) Enter the monthly expenses for the rest of the table. You can type them all in or copy them.

(f) The monthly expenses should all be entered now. The next step is to calculate total expenses for each month (the column totals) and for each expense category (the row totals).

Use the SUM function to create your formula for Total Wages. You can then copy the formula for the other row totals. You can do the same thing for the column totals (see the section on FORMULAE AND FUNCTIONS for additional help if necessary).

(g) The last row in the budget is the monthly balance. This can be created using a simple arithmetic formula (Hint: Balance = Wages - Expenses).

(h) Now, let's go back and fix up the row headings. Some of the row headings overflowed into column B, so you'll need to make column A wider to see all of the headings. Column width can be set using the command menu (Worksheet, Column, Set-Width). See the instructions under OTHER USEFUL FUNCTIONS - Setting Column Widths if you need additional assistance.

(i) The column headings fit easily into the cells with the default width, but are off centre with the column entries. Try retyping these headings (or editing them) to make them centred. (Hint: To centre a label type it with the ^ in front of the label (e.g., ^JAN)).

(j) The Balance row only shows the difference between wages and expenses for each month. It would also be useful to know the cumulative balance. Add a row called CUMULATIVE BALANCE below the current BALANCE. Construct a formula to calculate cumulative balance from the previous month's balance and the current balance. (Note: January's CUMULATIVE BALANCE is the same as the BALANCE).

(k) The Cumulative Balance row that you just created shows the monthly Cash on Hand. Notice that in January, this is a negative amount. This creates a problem if all of the expenses are to be paid in cash. While a number of possibilities for balancing the budget exist, one option would be to reduce the January Savings by $193 (the deficit amount) and increase the savings in February to offset it.

Make these changes to the worksheet. Notice that the totals are recalculated automatically to reflect these changes.

(l) Now that you have entered the 6 month budget, and ensured that the Cumulative Balance is over 0 for all of the months, you can save the worksheet for future reference. The command menu (with the choices FILE, SAVE) will assist you. If you require additional help, read the section SAVING A FILE in the notes.

(m) Erase the worksheet from the current working memory (see ERASING A SPREADSHEET). Exit Lotus 1-2-3.

	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Wages	2000	2000	2000	2000	2000	2000	12000
Expenses:							
Rent	475	475	475	475	475	475	2850
Food	362	362	362	362	362	362	2172
Clothing	150	150	150	150	150	150	900
Car Insurance	357					357	714
Car Expenses	94	94	94	94	94	94	564
Life Insurance	277					277	554
Loan Payment					731	731	1462
Leisure	200	200	200	200	200	200	1200
Savings	278	278	278	278	278	278	1668
Total Expenses	2193	1559	1559	1559	2290	2924	12084
Balance	-193	441	441	441	-290	-924	1281

Figure 1. Six Month Cash Budget

COMPUTER LEARNING STUDY
WordPerfect Exercises

1. This exercise will help you familiarize yourself with the keyboard and discover some of the basic features of WordPerfect 5.1.

Try typing the following sample paragraph.

> **In the editing process, a number of special features make the task easier. Words can be automatically "searched and replaced." Blocks of text can be "cut and pasted" electronically, rather than retyped. An electronic dictionary assists in checking that words are spelled correctly.**

(Be sure to hit enter at the end of the paragraph as if you were going to start a new line.)

Once you have typed the paragraph, turn on the editing codes in WordPerfect (ALT-F3). Notice the [SRt] codes at the ends of most of the lines, and the [HRt] code at the end of the last line. This code indicates the type of carriage return that has been inserted into the text. [SRt] means that a "soft" return has been inserted. Soft returns adjust automatically when you add or delete text. [HRt] means "hard" return. Hard returns will not change unless you delete them.

Turn the editing codes off (hit ALT-F3 again).

Add the following sentence between the first and second sentences. Notice that the rest of the text shifts to the right as you type, and wraps around to start new lines.

> **New lines are started automatically as the current line becomes full.**

Turn the editing codes back on. Notice that the soft returns have changed. Leaving the codes on, move your cursor to the very beginning of your paragraph (under the 'I' in In). In order to indent the first line of the paragraph, it is necessary to insert a [TAB] code into the document. Press the TAB key to add the code. Once you have hit the tab key, notice the code that is inserted in the reveal codes screen. Hit the BACKSPACE key to remove the tab.

If you wanted to indent every line of the paragraph (e.g., like I did in these notes) you could use WordPerfect's INDENT function (F4). With your cursor under the 'I' in In, hit the F4 key. The whole paragraph shifts over to the right, the lines adjust, and the [INDENT] code appears on the reveal codes screen. Move your cursor 1 place to the left (using the left arrow key). Notice how the cursor moves on both the editing screen and the reveal codes screen. Press the DELETE key to delete the indent code.

Turn the editing codes off.

Save the document (you may give it any 8 character name you want). The F10 key is the save function (if you need additional help, refer to the SAVING YOUR WORK section of your notes).

Once you have saved the document, make the following changes.

1. Remove the quotation marks around "searched and replaced" and "cut and pasted."

2. Add the following text **before** what you have already typed. Note that the first line is to be entered in BOLDFACE (see notes)

> **What is word processing?**
>
> A word processor is a particular kind of computer application with special features to handle written material. Word processing is more than just a computer based typewriter. With a typewriter, the words are put immediately to paper, and thus editing requires retyping. In word processing, documents are stored electronically and can be edited easily.

3. Turn the editing codes back on. Notice the [BOLD] code at the beginning of the first line and the [bold] code at the end of the line. These codes mark the start and end of the boldface type. Turn the codes back off.

4. Save the document again using the same name. This time, you will be asked if you want to replace the file. WordPerfect is asking if you want to replace the old version of your file (the one you saved before you added the new paragraph) with the updated version. Unless you really need to have both versions, you can respond Yes (y).

Exit WordPerfect (F7 is the Exit function). You will be asked if you want to save your document. Since you have just done so, there is no need to save it again. In the bottom right corner of the screen WordPerfect will tell you that the "text was not modified", meaning that no changes have been made since you last saved it.

2. This exercise will give you more practice with basic editing, and will let you practice moving blocks of text.

Start WordPerfect, and then retrieve the file "colds" (see Revising an Existing File for information on how to do this).

Look through the document on your screen using the arrow keys. Turn the editing codes on. Notice the [INDENT] codes before some of the lines. The indent code starts every line of text one tab setting in from the left margin until a hard return is entered (e.g., until you hit the enter key).

Make the changes indicated on the printout (see next page).

N.B. When you move the lines indicated (e.g., the point about gargling) be sure you move the indent code with it.

Save the file with your changes (you can replace the old version of COLDS), and then print the file.

Make the following additional changes to the file.

1. Change the left and right margins to 1 1/2" (be sure you are at the beginning of the file when you change the format).

2. Change the top and bottom margins to 1 1/2" also.

3. On the printed document, you will notice that there are no page numbers. Add page numbers following the directions under PAGE NUMBERS.

4. In the current version, the text has a "ragged right" margin. An alternative to this format is a fully justified format, where the text forms a rectangular block on the page. Using the line format menu, try to change the text to a fully justified format.

Check the spelling of the document and print it again (notice the differences in the printed output).

APPENDIX O

COMPREHENSION TESTS

- MAIN STUDY -

Computer Learning Study - Lotus 1-2-3 Training
Language Quiz

1. (a) If you place the pointer on a particular cell, how can you tell if that cell contains a LABEL? Be specific.

   (b) Given that the pointer is on cell **C9**, and the mode is **READY**, what cell would the pointer be on after you pressed each of the following keys?

   HOME

   PGDN

   UP ARROW

   ENTER

   (c) Cell **E5** contains the following formula: @SUM(E2..E4). After you copy it to cell **H5**, what will the entry in cell **H5** be?

2. Which one key can you use to back out of the menu structure and return the mode to ready?

3. Write a single formula to add up the items in column A, rows 3-7 and subtract from the total the sum of column B, rows 3-7.

4. What menu choices must you use to do the following:

   (a) Change the format of a specific area of the worksheet so that numbers include leading $ signs, commas and 2 decimal places?

   (b) Resave an existing worksheet?

   (c) Remove a column from the current worksheet

Computer Learning Study - WordPerfect Training

Language Quiz

1. (a) What is the function of each of the following keys?

F5

F8

CTRL-RIGHT ARROW

CTRL-F2

(b) How do you accomplish each of the following tasks?

MAKE TEXT BOLD

CHECK THE SPELLING OF A DOCUMENT

GET HELP

(c) How can you tell the difference between a soft page end and a hard page end without looking at the editing codes.

2. If you had created a new document in WordPerfect and immediately after finishing pressed the following keys, what would happen? Be as specific as possible.

SHIFT-F7 1

F7 N Y

F10 yes<enter>

3. How would you go about copying a block of text within a WordPerfect file? Be specific.

4. Below is a reveal codes screen of a document. What would the printed document look like?

```
[Ln Spacing:1][T/B Margins:1", 1"][L/R Margins:1.5", 1.5"][Ln
Spacing:3][Centre]ABC Company[HRt]
[BOLD][bold]Annual Report[HRt]
[HRt]
[Ln Spacing:1.5]Fiscal year 1990 was a successful year for the
[UND]ABC[SRt]
Company[und]. Sales were 5% higher than planned while profits
were[SRt]
up 7%.[HRt]
```

APPENDIX P

PERFORMANCE TESTS

- MAIN STUDY -

Computer Learning Study
Lotus 1-2-3
Timed Exercises

The following exercises are being used to help us evaluate the training process and to test hypotheses about learning. The results are strictly confidential and will not be discussed with anyone outside the research project.

You will have 1 hour to complete the 2 questions. You may use any of your notes if they will help you. Please do not discuss the exercises with anyone else.

1. Enter 5 year sales forecasts for the ABC company according to the following instructions.

   (a) Enter the row headings in column A. Column A should be 20 characters wide to hold the headings. You will need headings for each of the following categories:

   TOTAL MARKET (UNITS)
   MARKET SHARE (%)
   SALES (UNITS)
   SELLING PRICE ($)
   SALES ($)

   (b) Enter the column headings in columns B through F. The headings should be centred. The column headings should be the years for the forecasts (1991-1995).

   (c) Enter the Total Market and the Market Share forecasts for each of the years. The Total Market forecast is 120,000 units per year. The Market Share forecast is 5% in the first 2 years, then 8% in year 3, and 10% in years 4 and 5.

   (d) Compute the unit sales from the Market Share and Total Market.

   (e) Enter the selling price. Format this row for currency (Hint: Try RANGE FORMAT). The selling price is $6.75 per unit and does not change over the years.

   (f) Compute the sales (in dollars) from the unit sales and selling price. This row should also be formatted as currency. (You may have to widen the columns to make room.)

(g) Save the worksheet in a file called SALES1.WK1.

(h) Print the worksheet.

(i) Now that the worksheet is entered, you can test the impact of different assumptions about market share, selling price and market growth. Adjust the worksheet to reflect each of the following conditions and save the result at each step.

First, change the market share in each year to 10%. Note the change in sales. Save the worksheet in a file called SALES2.WK1.

Next, change the Total Market projections. Assume a 4% annual growth rate in the market. (Hint: With a 4% growth rate, each successive year is 1.04 times the size of the previous year's market). Save the worksheet in a file called SALES3.WK1.

Lastly, change the selling price. Adjust the price by the rate of inflation (assume 6%). Save this final version of the worksheet in SALES4.WK1.

(j) Exit Lotus 1-2-3.

2. This exercise shows you how Lotus 1-2-3 can be used to aid in decision making. The problem is a car buying decision. Create an appropriate model in Lotus 1-2-3 to help you solve the problem.

(a) You are in the middle of deciding whether to purchase a newer sedan or an older sports car. Torn between the desire to be sporty and the urge to be practical, you decide to create a model of the problem using Lotus 1-2-3.

You want to determine which car has the least net cost given that the financing period will be 30 months; that you plan to hold onto the car until you pay it off, and then sell it; and that you plan to drive 16,000 km per year.

The sedan has the following estimated costs, gas mileage, and trade-in value:

Fuel price:	52.9 cents per litre
Insurance:	$600.00 per year
Licence plates:	$175 per year (you do not get a refund for owning a car part of a year)
Operating Costs:	$33.00 per month
Payments:	$275.00 per month
Gas mileage:	9.4 litres per 100 km
Trade-in value:	$1,500.00

The sports car has the following estimated costs, gas mileage, and trade-in value:

Fuel price:	52.9 cents per litre
Insurance:	$700.00 per year
Licence plates:	$175.00 per year (you do not get a refund for owning a car part of a year)
Operating Costs:	$67.00 per month
Payments:	$175.00 per month
Gas mileage:	15.7 litres per 100 km
Trade-in value:	$2,000.00

Save the worksheet you create in a file called CAR1.WK1. Print a hard copy of the file and note your decision on the output.

(b) Now, what if you decide to keep the car you plan to purchase for 3 years -- which car would you buy? Assume that the trade-in values remain the same for this situation.

Save this worksheet in a file called CAR2.WK1 and print a hard copy. Again, note your decision on the hard copy.

Computer Learning Study
WordPerfect
Timed Exercises

The following exercises are being used to help us evaluate the training process and to test hypotheses about learning. The results are strictly confidential and will not be discussed with anyone outside the research project.

You will have 1 hour to complete the 2 questions. You may use any of your notes if they will help you. Please do not discuss the exercises with anyone else.

1. Please type the attached business letter according to the following instructions.

   (a) Start the letter 1.5 inches from the top of the page. Enter the return address at the right margin (Hint: this is referred to as FLUSH RIGHT).

   (b) Leave one blank line after the address and enter the date (also flush right). Use a DATE CODE to enter the date if you can.

   (c) Leave several blank lines after the date and enter the inside address flush with the left margin.

   (d) Enter the body of the letter. It should be single spaced, with a double space left between paragraphs.

   (e) Enter the closing. These lines should start 5 inches from the left margin. Leave 5 blank lines for the signature.

   (f) Once the letter is complete, go back and change the format of the letter to the following:

   Line Spacing: 1.1
   Left/Right Margins: 1.5 inches each
   Justification: Full
   Page Numbering: Bottom Centre

   (g) Print the letter.

   (h) Save in a file called LETTER.FIN

576 Alberta Street
London, Ontario
N5B 7S7

today's date

Mr. Reginald Harris
Director, Training Services
ABC Company
421 Dundurn Place
London, Ontario

Dear Mr. Harris,

I have just returned from a two day workshop on Lotus 1-2-3 and WordPerfect. I am interested in pursuing further training and would like some information on the course offerings of the ABC Company.

Please send me information on advanced courses in WordPerfect and Lotus, as well as introductory courses on dBase IV and Harvard Graphics.

Tnank you for your assistance.

Sincerely,

your name

2. WordPerfect has Desktop Publishing features to help you create professional looking reports and newsletters. This exercise will give you the opportunity to try out some of those features.

   (a) Retrieve the document **newstext.wkb**. This file contains 3 newspaper style articles, such as might be found in a company newsletter.

   (b) Newsletters are typically formatted with more than 1 column per page to enhance readability. WordPerfect allows you to create Newspaper Columns. The relevant section of the manual has been copied for you (see attached).

   Try to reformat the document with 2 columns on the page. Use the information in the manual and any other reference (e.g., Help function) that you wish. View the document (**SHIFT-F7 6**) to see what the page looks like.

   (c) The headlines for the 3 articles don't stand out very well. Make them boldfaced.

   (d) At the very top of the document, add a title (in boldface) for the newsletter: **HALVA Herald**. In order to make the text bigger, block the title (using **ALT-F4**) and then change the font (or typestyle), using the **CTRL-F8 1** (font size) option. Make the text Extra Large.

   Note that this title should not be in the column format, but should stretch across the entire page.

   Put a single solid line across the page above and below the title to set it off from the rest of the text.

   View the document again. Notice that when you changed the font for the title, the rest of the text was changed too. Position your cursor after the title (that you want in big type) but before the text (that you want in smaller type) and change the font again back to a smaller type. Now view the document again.

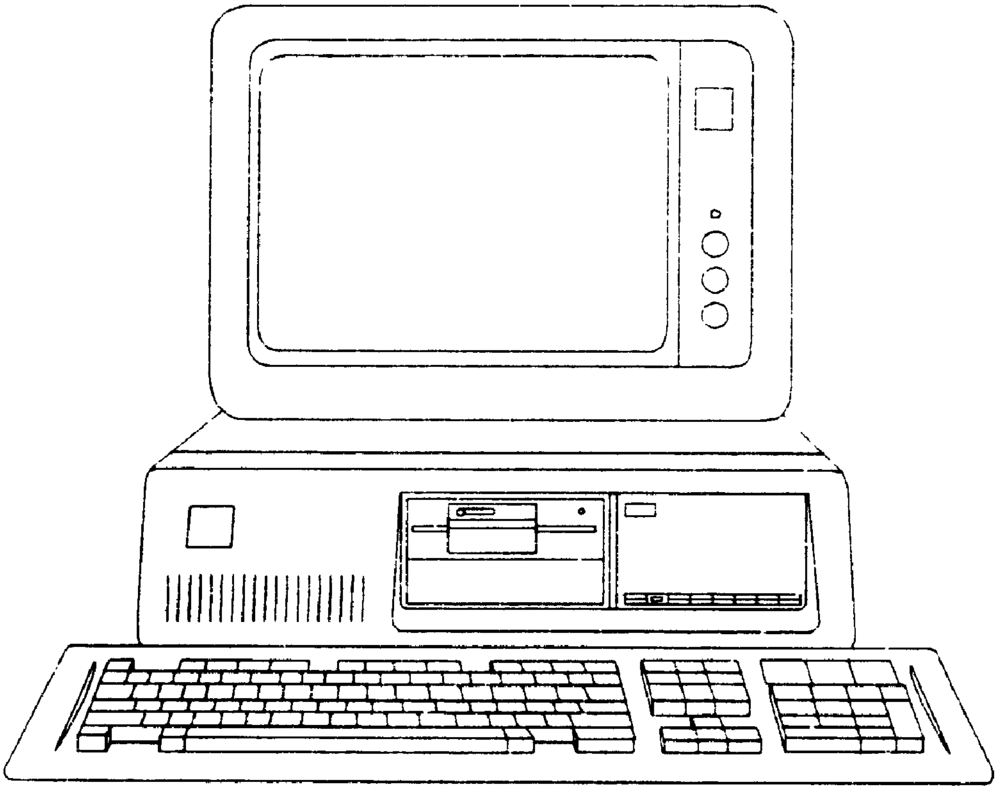
   (e) Save the edited document (you can replace the old version) and print a hard copy of the newsletter.

APPENDIX Q

CONSENT FORM
AND
BACKGROUND QUESTIONNAIRE

- MAIN STUDY -

COMPUTER LEARNING STUDY



School of Business Administration
The University of Western Ontario

April 1991

Participant Information

Welcome to the Computer Learning Study. This research is part of a series of studies designed to improve our understanding of how people learn to use computers.

As a participant in this phase of the study, you will be given a 2 day introductory training course in Lotus 1-2-3 and WordPerfect. This course will consist of a demonstration and discussion of the software and an opportunity to practice using Lotus 1-2-3 in a series of exercises. The training notes and exercises that we will use in the workshop are yours to keep as a reference. Please make any additional notes that will help you to better use Lotus 1-2-3 and WordPerfect.

You will be asked to complete a number of questionnaires over the course of the workshop. The questions concern your current use of computers, and your feelings about using them. In addition, a number of demographic questions are asked. You are free to skip any questions you find objectionable. Your responses to the questionnaire are completely confidential.

At the end of the training session, you will be completely debriefed about the specific purpose and hypotheses of the study. You are free to withdraw from the study at any time.

If you agree to participate in the research, please complete the consent form on the next page.

Computer Learning Study

Consent Form

I have read the Participant Information sheet, and agree to participate in the Computer Learning Study. I understand that any information I provide is completely confidential and will be used for research purposes only. I further understand that I am free to withdraw from the study at any time.

Signature ____

Name (Please print) ____________________________________

Date ____

COMPUTER LEARNING STUDY

BACKGROUND QUESTIONNAIRE

Name ____________________________

Date ____________________________

SECTION A

This part of the questionnaire asks about your use of computers at work and at home. For each question, please circle the response that best describes <u>your</u> use of computers.

Q-1. How much experience do you have with computers? (Circle number)

1 NONE
2 A LITTLE BIT
3 SOME
4 A FAIR BIT
5 A LOT

Q-2. For each of the following types of computer systems, please indicate how familiar you are with using it. (Circle number)

		NOT AT ALL FAMILIAR		SOMEWHAT FAMILIAR		VERY FAMILIAR
1	APPLE PERSONAL COMPUTERS........	1	2	3	4	5
2	IBM PCs (OR CLONES).............	1	2	3	4	5
3	MINICOMPUTERS...................	1	2	3	4	5
4	MAINFRAME COMPUTERS.............	1	2	3	4	5

Q-3. For each of the following types of software, please indicate how familiar you are with using it. (Circle number)

		NOT AT ALL FAMILIAR		SOMEWHAT FAMILIAR		VERY FAMILIAR
1	SPREADSHEETS....................	1	2	3	4	5
2	WORD PROCESSORS.................	1	2	3	4	5
3	DATA BASE PACKAGES..............	1	2	3	4	5
4	STATISTICAL PACKAGES............	1	2	3	4	5
5	GRAPHICS PROGRAMS...............	1	2	3	4	5
6	ELECTRONIC MAIL.................	1	2	3	4	5
7	PROGRAMMING LANGUAGES...........	1	2	3	4	5

Q-4. Approximately how much time do you spend each day using a computer at your place of work?

______ HOURS and ______ MINUTES

Q-5. On average, how frequently do you use a computer at work? (Circle number)

1 SEVERAL TIMES A DAY
2 ABOUT ONCE A DAY
3 A FEW TIMES A WEEK
4 A FEW TIMES A MONTH
5 ONCE A MONTH
6 LESS THAN ONCE A MONTH

Q-6. Do you have a computer at home? (Circle number)

1 YES
2 NO →

If you do not have a computer at home, please go to Question 8.

Q-7. Approximately how much time do you spend each day using your home computer?

WEEKDAYS:

______ HOURS and ______ MINUTES

WEEKENDS:

______ HOURS and ______ MINUTES

Q-8. To what extent have you personally used Lotus 1-2-3 before? (Circle number)

1 NOT AT ALL
2 A LITTLE BIT
3 SOMEWHAT
4 A FAIR BIT
5 A LOT

Q-9. To what extent have you personally used Wordperfect before? (Circle number)

1 NOT AT ALL
2 A LITTLE BIT
3 SOMEWHAT
4 A FAIR BIT
5 A LOT

The next two questions ask about the kinds of computer training you may have received.

Q-10. For each of the following sources of training, please indicate **how much** computer training you have received from that source. (Circle number)

		NONE	SLIGHT	MODERATE	SUBSTANTIAL
1	COLLEGE OR UNIVERSITY...........	1	2	3	4
2	HARDWARE OR SOFTWARE VENDOR.....	1	2	3	4
3	CONSULTANT......................	1	2	3	4
4	COMPANY TRAINING PROGRAM........	1	2	3	4
5	SELF-TRAINING (e.g., tutorials).	1	2	3	4
6	OTHER (e.g., a friend)..........	1	2	3	4

Q-11. For each of the training sources from which you have received computer training, please indicate the **quality** of the training provided. (Circle number)

		POOR	FAIR	OK	GOOD	EXCELLENT
1	COLLEGE OR UNIVERSITY...........	1	2	3	4	5
2	HARDWARE OR SOFTWARE VENDOR.....	1	2	3	4	5
3	CONSULTANT......................	1	2	3	4	5
4	COMPANY TRAINING PROGRAM........	1	2	3	4	5
5	SELF-TRAINING (e.g., tutorials).	1	2	3	4	5
6	OTHER (e.g., a friend)..........	1	2	3	4	5

SECTION B

The following statements describe the outcomes that people might experience as a result of using a computer. For each item indicate whether you feel you would be likely to experience that outcome from your computer use.

IF I USE A COMPUTER...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-12.	...I will be better organized.......	1	2	3	4	5
Q-13.	...my co-workers will perceive me as competent.........................	1	2	3	4	5
Q-14.	...I will increase my sense of accomplishment......................	1	2	3	4	5
Q-15.	...I will increase my chances of obtaining a promotion...............	1	2	3	4	5
Q-16.	...I will increase my effectiveness on the job..........................	1	2	3	4	5
Q-17.	...I will be seen as higher in status by my peers..................	1	2	3	4	5
Q-18.	...I will increase my chances of getting a raise.....................	1	2	3	4	5
Q-19.	...I will spend less time on routine job tasks...................	1	2	3	4	5
Q-20.	...I will increase the quality of output of my job....................	1	2	3	4	5
Q-21.	...I will increase the quantity of output for the same amount of effort.............................	1	2	3	4	5
Q-22.	...I will be less reliant on clerical support staff..............	1	2	3	4	5

Now consider the probable outcomes of using specifically WordPerfect. For each of the following items, please indicate whether you feel you would be likely to experience that outcome from your use of WordPerfect.

IF I USE WORDPERFECT...

VERY UNLIKELY NEUTRAL VERY LIKELY

Q-23. ...I will be better organized.......1 2 3 4 5

Q-24. ...my co-workers will perceive me as competent.........................1 2 3 4 5

Q-25. ...I will increase my sense of accomplishment......................1 2 3 4 5

Q-26. ...I will increase my chances of obtaining a promotion...............1 2 3 4 5

Q-27. ...I will increase my effectiveness on the job..........................1 2 3 4 5

Q-28. ...I will be seen as higher in status by my peers..................1 2 3 4 5

Q-29. ...I will increase my chances of getting a raise.....................1 2 3 4 5

Q-30. ...I will spend less time on routine job tasks...................1 2 3 4 5

Q-31. ...I will increase the quality of output of my job....................1 2 3 4 5

Q-32. ...I will increase the quantity of output for the same amount of effort..............................1 2 3 4 5

Q-33. ...I will be less reliant on clerical support staff..............1 2 3 4 5

Now consider the probable outcomes of using specifically Lotus 1-2-3. For each of the following items, please indicate whether you feel you would be likely to experience that outcome from your use of Lotus 1-2-3.

IF I USE LOTUS 1-2-3...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-34.	...I will be better organized	1	2	3	4	5
Q-35.	...my co-workers will perceive me as competent	1	2	3	4	5
Q-36.	...I will increase my sense of accomplishment	1	2	3	4	5
Q-37.	...I will increase my chances of obtaining a promotion	1	2	3	4	5
Q-38.	...I will increase my effectiveness on the job	1	2	3	4	5
Q-39.	...I will be seen as higher in status by my peers	1	2	3	4	5
Q-40.	...I will increase my chances of getting a raise	1	2	3	4	5
Q-41.	...I will spend less time on routine job tasks	1	2	3	4	5
Q-42.	...I will increase the quality of output of my job	1	2	3	4	5
Q-43.	...I will increase the quantity of output for the same amount of effort	1	2	3	4	5
Q-44.	...I will be less reliant on clerical support staff	1	2	3	4	5

The next few statements describe feelings that some people have about computers. For each statement, please indicate the extent to which you agree or disagree with the feelings being expressed.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-45.	I like working with computers	1	2	3	4	5
Q-46.	I look forward to those aspects of my job that require me to use a computer	1	2	3	4	5
Q-47.	Once I start working on the computer, I find it hard to stop	1	2	3	4	5
Q-48.	Using a computer is frustrating for me	1	2	3	4	5
Q-49.	I get bored quickly when working on a computer	1	2	3	4	5

The next few items concern your opportunity to use WordPerfect and Lotus 1-2-3 in your current job. Pease indicate the extent to which you agree or disagree with each of the following statements.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-50.	I have the opportunity to use WordPerfect in my current job	1	2	3	4	5
Q-51.	Using WordPerfect is important for my job	1	2	3	4	5
Q-52.	The skills that I will learn in WordPerfect training will be immediately useful to me in my job	1	2	3	4	5
Q-53.	I have the opportunity to use Lotus 1-2-3 in my current job	1	2	3	4	5
Q-54.	Using Lotus 1-2-3 is important for my job	1	2	3	4	5
Q-55.	The skills that I will learn in Lotus 1-2-3 training will be immediately useful to me in my job	1	2	3	4	5

SECTION C

This part of the questionnaire asks you about your ability to use an <u>unfamiliar</u> piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		NOT AT ALL CONFIDENT				MODERATELY CONFIDENT					TOTALLY CONFIDENT
...if there was someone giving me step by step instructions.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so.

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		NOT AT ALL CONFIDENT · MODERATELY CONFIDENT · TOTALLY CONFIDENT
Q-56.	...if there was no one around to tell me what to do as I go.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-57.	...if I had only the software manuals for reference.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-58.	...if I had seen someone else using it before trying it myself.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-59.	...if I could call someone for help if I got stuck.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-60.	...if someone else had helped me get started.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-61.	...if I had a lot of time to complete the job for which the software was provided.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-62.	...if I had just the built-in help facility for assistance.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-63.	...if someone showed me how to do it first.	YES.....1 2 3 4 5 6 7 8 9 10 NO

Now consider specifically WordPerfect. The following questions ask you to indicate whether you think you could use WordPerfect under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using WordPerfect. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING WORDPERFECT...

		NOT AT ALL CONFIDENT (1) MODERATELY CONFIDENT (5) TOTALLY CONFIDENT (10)
Q-64.	...if there was no one around to tell me what to do as I go.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-65.	...if I had only the software manuals for reference.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-66.	...if I had seen someone else using it before trying it myself.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-67.	...if I could call someone for help if I got stuck.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-68.	...if someone else had helped me get started.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-69.	...if I had a lot of time to complete the job for which the software was provided.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-70.	...if I had just the built-in help facility for assistance.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-71.	...if someone showed me how to do it first.	YES.....1 2 3 4 5 6 7 8 9 10 NO

Now consider specifically Lotus 1-2-3. The following questions ask you to indicate whether you think you could use Lotus 1-2-3 under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using Lotus 1-2-3. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING LOTUS 1-2-3...

NOT AT ALL CONFIDENT — MODERATELY CONFIDENT — TOTALLY CONFIDENT

Q-72.	...if there was no one around to tell me what to do as I go.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-73.	...if I had only the software manuals for reference.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-74.	...if I had seen someone else using it before trying it myself.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-75.	...if I could call someone for help if I got stuck.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-76.	...if someone else had helped me get started.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-77.	...if I had a lot of time to complete the job for which the software was provided.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-78.	...if I had just the built-in help facility for assistance.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-79.	...if someone showed me how to do it first.	YES.....1 2 3 4 5 6 7 8 9 10 NO

SECTION D

This section of the questionnaire asks about your feelings towards using computers. The following statements reflect various feelings towards using computers that you may or may not hold. For each statement, please indicate the extent to which you agree or disagree with the feelings expressed.

Please circle your response.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-80.	I feel insecure about my ability to interpret a computer printout	1	2	3	4	5
Q-81.	I look forward to using a computer on my job	1	2	3	4	5
Q-82.	I do not think I would be able to learn a computer programming language	1	2	3	4	5
Q-83.	The challenge of learning about computers is exciting	1	2	3	4	5
Q-84.	I am confident that I can learn computer skills	1	2	3	4	5
Q-85.	Anyone can learn to use a computer if they are patient enough	1	2	3	4	5
Q-86.	Learning to operate computers is like learning any new skill - the more you practice, the better you become	1	2	3	4	5
Q-87.	I am afraid that if I use computers I will become dependent on them and lose some of my reasoning skills	1	2	3	4	5
Q-88.	I feel computers are necessary tools in educational settings	1	2	3	4	5

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
		☐		☐		☐
Q-89.	I feel that I will be able to keep up with the advances happening in the computer field	1	2	3	4	5
Q-90.	I dislike working with machines that are smarter than I am	1	2	3	4	5
Q-91.	I feel apprehensive about using computers	1	2	3	4	5
Q-92.	I have difficulty in understanding the technical aspects of computers	1	2	3	4	5
Q-93.	It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key	1	2	3	4	5
Q-94.	I hesitate to use a computer for fear of making mistakes that I cannot correct	1	2	3	4	5
Q-95.	You have to be a genius to understand all the special keys contained on most computer terminals	1	2	3	4	5
Q-96.	If given the opportunity, I would like to learn more about computers	1	2	3	4	5
Q-97.	Computers are somewhat intimidating to me	1	2	3	4	5
Q-98.	I feel computers are necessary tools in work settings	1	2	3	4	5
Q-99.	I am sure that with time and practice I will be as comfortable working with computers as I am in working a typewriter	1	2	3	4	5

SECTION E

This section of the questionnaire asks about the computer use and attitudes of other people that you know, and about the support provided for computing in your organization.

Q-100. To what extent do you feel that using a computer is encouraged or discouraged by each of the following groups of people? (Circle number)

	USE IS STRONGLY DISCOURAGED		USE IS NEITHER ENCOURAGED NOR DISCOURAGED		USE IS STRONGLY ENCOURAGED	
YOUR PEERS IN YOUR ORGANIZATION...	1	2	3	4	5	N/A
YOUR PEERS IN OTHER ORGANIZATIONS.	1	2	3	4	5	N/A
YOUR MANAGER......................	1	2	3	4	5	N/A
OTHER MANAGEMENT..................	1	2	3	4	5	N/A
YOUR SUBORDINATES.................	1	2	3	4	5	N/A

Q-101. To what extent do each of the following groups of people use computers? (Circle number)

	TO A VERY LITTLE EXTENT		TO SOME EXTENT		TO A VERY GREAT EXTENT	
YOUR PEERS IN YOUR ORGANIZATION...	1	2	3	4	5	N/A
YOUR PEERS IN OTHER ORGANIZATIONS.	1	2	3	4	5	N/A
YOUR MANAGER......................	1	2	3	4	5	N/A
OTHER MANAGEMENT..................	1	2	3	4	5	N/A
YOUR SUBORDINATES.................	1	2	3	4	5	N/A

The next few questions concern the amount of support your organization provides for computer users. Please indicate the extent to which you agree or disagree with each of the following statements.

	STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-102. Guidance is available to me in the selection of hardware, software, printers, and other equipment................	1	2	3	4	5
Q-103. A specific person (or group) is available for assistance with software difficulties.............	1	2	3	4	5
Q-104. A specific person (or group) is available for assistance with hardware difficulties.............	1	2	3	4	5
Q-105. Specialized instruction and education concerning popular software are available to me..........	1	2	3	4	5
Q-106. My co-workers are able to provide assistance when I encounter problems using the computer............	1	2	3	4	5
Q-107. In general, I feel this organization has been very supportive of computer users...........	1	2	3	4	5

SECTION F

The remainder of the questionnaire asks for some information about yourself. This information is important to allow us to study the effects of differences between people on their feelings about computers.

Q-108. Please describe the organization in which you work.

NAME OF ORGANIZATION ______________________________

INDUSTRY ______________________________

NUMBER OF EMPLOYEES______________________________

Q-109. How long have you worked for this organization?

_______ YEARS and _______ MONTHS

Q-110. Which of the following categories best describes your functional area? (Please choose only one)

1 ACCOUNTING
2 ENGINEERING, DESIGN, R&D
3 FINANCE
4 GENERAL MANAGEMENT
5 PRODUCTION
6 MARKETING OR SALES
7 INFORMATION SYSTEMS
8 HUMAN RESOURCES
9 OTHER
Please specify ______________________________

Q-111 What is the level of your position? (Circle number)

1 EXECUTIVE
2 MIDDLE MANAGEMENT
3 FIRST LINE MANAGEMENT
4 PROFESSIONAL
5 TECHNICAL
6 CLERICAL OR SECRETARIAL
7 OTHER
Please specify ______________________________

Q-112. Do you consider your position to be a line or a staff position? (Circle number)

1 LINE
2 STAFF

Q-113. How many people report directly to you?

_________ PEOPLE

Q-114. What is your age?

_________ YEARS

Q-115. What is your gender? (Circle number)

1 FEMALE
2 MALE

Q-116. Which is the highest level of education that you have completed? (Circle the last category that applies)

1 SOME VOCATIONAL OR HIGH SCHOOL
2 COMPLETED VOCATIONAL OR HIGH SCHOOL
3 SOME COLLEGE OR UNIVERSITY
4 COMPLETED COLLEGE OR UNIVERSITY
5 SOME GRADUATE WORK
6 A GRADUATE DEGREE

Q-117. What is your primary educational background? (Circle number)

1 BUSINESS
2 ARTS
3 SCIENCE
4 SOCIAL SCIENCE
5 OTHER
Please specify ______________________________

APPENDIX R

POST TRAINING QUESTIONNAIRE

- MAIN STUDY -

COMPUTER LEARNING STUDY

POST-TRAINING QUESTIONNAIRE

Name ______________________

Date ______________________

SECTION A

The following statements describe the outcomes that people might experience as a result of using a computer. For each item indicate whether you feel you would be likely to experience that outcome from your computer use.

IF I USE A COMPUTER...

	VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-1. ...I will be better organized......	.1	2	3	4	5
Q-2. ...my co-workers will perceive me as competent......................	.1	2	3	4	5
Q-3. ...I will increase my sense of accomplishment.....................	.1	2	3	4	5
Q-4. ...I will increase my chances of obtaining a promotion..............	.1	2	3	4	5
Q-5. ...I will increase my effectiveness on the job......................	.1	2	3	4	5
Q-6. ...I will be seen as higher in status by my peers.................	.1	2	3	4	5
Q-7. ...I will increase my chances of getting a raise....................	.1	2	3	4	5
Q-8. ...I will spend less time on routine job tasks.................	.1	2	3	4	5
Q-9. ...I will increase the quality of output of my job..................	.1	2	3	4	5
Q-10 ...I will increase the quantity of output for the same amount of effort............................	.1	2	3	4	5
Q-11 ...I will be less reliant on clerical support staff............	.1	2	3	4	5

Now consider the probable outcomes of using specifically WordPerfect. For each of the following items, please indicate whether you feel you would be likely to experience that outcome from your use of WordPerfect.

IF I USE WORDPERFECT...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-12.	...I will be better organized	1	2	3	4	5
Q-13.	...my co-workers will perceive me as competent	1	2	3	4	5
Q-14.	...I will increase my sense of accomplishment	1	2	3	4	5
Q-15.	...I will increase my chances of obtaining a promotion	1	2	3	4	5
Q-16.	...I will increase my effectiveness on the job	1	2	3	4	5
Q-17.	...I will be seen as higher in status by my peers	1	2	3	4	5
Q-18.	...I will increase my chances of getting a raise	1	2	3	4	5
Q-19.	...I will spend less time on routine job tasks	1	2	3	4	5
Q-20.	...I will increase the quality of output of my job	1	2	3	4	5
Q-21.	...I will increase the quantity of output for the same amount of effort	1	2	3	4	5
Q-22.	...I will be less reliant on clerical support staff	1	2	3	4	5

Now consider the probable outcomes of using specifically Lotus 1-2-3. For each of the following items, please indicate whether you feel you would be likely to experience that outcome from your use of Lotus 1-2-3.

IF I USE LOTUS 1-2-3...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-23.	...I will be better organized.......	1	2	3	4	5
Q-24.	...my co-workers will perceive me as competent........................	1	2	3	4	5
Q-25.	...I will increase my sense of accomplishment......................	1	2	3	4	5
Q-26.	...I will increase my chances of obtaining a promotion...............	1	2	3	4	5
Q-27.	...I will increase my effectiveness on the job..........................	1	2	3	4	5
Q-28.	...I will be seen as higher in status by my peers..................	1	2	3	4	5
Q-29.	...I will increase my chances of getting a raise.....................	1	2	3	4	5
Q-30.	...I will spend less time on routine job tasks...................	1	2	3	4	5
Q-31.	...I will increase the quality of output of my job.....................	1	2	3	4	5
Q-32.	...I will increase the quantity of output for the same amount of effort..............................	1	2	3	4	5
Q-33.	...I will be less reliant on clerical support staff..............	1	2	3	4	5

SECTION B

This part of the questionnaire asks you about your ability to use an unfamiliar piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		NOT AT ALL CONFIDENT				MODERATELY CONFIDENT				TOTALLY CONFIDENT
...if there was someone giving me step by step instructions.	YES.....	1	2	3	4	5	6	7	8	9 10
	NO									

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so.

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

NOT AT ALL CONFIDENT	MODERATELY CONFIDENT	TOTALLY CONFIDENT

Q-34. ...if there was no one around to tell me what to do as I go.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-35. ...if I had only the software manuals for reference.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-36. ...if I had seen someone else using it before trying it myself.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-37. ...if I could call someone for help if I got stuck.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-38. ...if someone else had helped me get started.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-39. ...if I had a lot of time to complete the job for which the software was provided.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-40. ...if I had just the built-in help facility for assistance.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Q-41. ...if someone showed me how to do it first.
YES.....1 2 3 4 5 6 7 8 9 10
NO

Now consider specifically WordPerfect. The following questions ask you to indicate whether you think you could use WordPerfect under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using WordPerfect. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING WORDPERFECT...

			NOT AT ALL CONFIDENT				MODERATELY CONFIDENT					TOTALLY CONFIDENT
Q-42.	...if there was no one around to tell me what to do as I go.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-43.	...if I had only the software manuals for reference.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-44.	...if I had seen someone else using it before trying it myself.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-45.	...if I could call someone for help if I got stuck.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-46.	...if someone else had helped me get started.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-47.	...if I had a lot of time to complete the job for which the software was provided.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-48.	...if I had just the built-in help facility for assistance.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-49.	...if someone showed me how to do it first.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										

Now consider specifically Lotus 1-2-3. The following questions ask you to indicate whether you think you could use Lotus 1-2-3 under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using Lotus 1-2-3. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING LOTUS 1-2-3...

		NOT AT ALL CONFIDENT	MODERATELY CONFIDENT	TOTALLY CONFIDENT
Q-50.	...if there was no one around to tell me what to do as I go.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-51.	...if I had only the software manuals for reference.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-52.	...if I had seen someone else using it before trying it myself.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-53.	...if I could call someone for help if I got stuck.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-54.	...if someone else had helped me get started.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-55.	...if I had a lot of time to complete the job for which the software was provided.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-56.	...if I had just the built-in help facility for assistance.	YES.....1 2 3 4 5 6 7 8 9 10 NO		
Q-57.	...if someone showed me how to do it first.	YES.....1 2 3 4 5 6 7 8 9 10 NO		

The next few statements describe feelings that some people have about computers. For each statement, please indicate the extent to which you agree or disagree with the feelings being expressed.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-58.	I like working with computers..........	1	2	3	4	5
Q-59.	I look forward to those aspects of my job that require me to use a computer..	1	2	3	4	5
Q-60.	Once I start working on the computer, I find it hard to stop.................	1	2	3	4	5
Q-61.	Using a computer is frustrating for me.	1	2	3	4	5
Q-62.	I get bored quickly when working on a computer...............................	1	2	3	4	5

The next few items concern your opportunity to use WordPerfect and Lotus 1-2-3 in your current job. Pease indicate the extent to which you agree or disagree with each of the following statements.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-63.	I have the opportunity to use WordPerfect in my current job..........	1	2	3	4	5
Q-64.	Using WordPerfect is important for my job..................................	1	2	3	4	5
Q-65.	The skills that I will learn in WordPerfect training will be immediately useful to me in my job.....	1	2	3	4	5
Q-66.	I have the opportunity to use Lotus 1-2-3 in my current job................	1	2	3	4	5
Q-67.	Using Lotus 1-2-3 is important for my job..................................	1	2	3	4	5
Q-68.	The skills that I will learn in Lotus 1-2-3 training will be immediately useful to me in my job.................	1	2	3	4	5

APPENDIX S

FOLLOW UP QUESTIONNAIRES

- MAIN STUDY -

COMPUTER LEARNING STUDY

FOLLOW UP QUESTIONNAIRE - VIDEO FOR BOTH[8]

Name ____________________

Date ____________________

---

[8] Separate questionnaires were used for each of the groups. The questions regarding the videotapes were only included for those groups who had actually viewed the tapes.

SECTION A

This part of the questionnaire asks you to rate various aspects of the training course. For each question please **circle** the response that best describes how you feel about the training.

Q-1. Please evaluate the WordPerfect training on each of the following dimensions:

(a) Was the Lecture/Demonstration:

1	2	3	4	5
HELPFUL				NOT HELPFUL

(b) Were the Training Notes (the notes in the binders):

1	2	3	4	5
HELPFUL				NOT HELPFUL
1	2	3	4	5
WELL PRODUCED				POORLY PRODUCED
1	2	3	4	5
EASY TO FOLLOW				HARD TO FOLLOW

(c) Were the Practice Exercises:

1	2	3	4	5
HELPFUL				NOT HELPFUL
1	2	3	4	5
WELL PRODUCED				POORLY PRODUCED
1	2	3	4	5
EASY TO FOLLOW				HARD TO FOLLOW

(d) Was the Videotape:

1	2	3	4	5
HELPFUL				NOT HELPFUL
1	2	3	4	5
WELL PRODUCED				POORLY PRODUCED

What, if anything, did you learn from the videotape?

____

____

____

____

____

____

(e) Overall, how would you rate the WordPerfect training?

1	2	3	4	5
HELPFUL				NOT HELPFUL

Q-2. Please indicate the extent to which you believe the WordPerfect training helped you become competent at using the software.

1	2	3	4	5
TO A VERY LITTLE EXTENT		TO SOME EXTENT		TO A VERY GREAT EXTENT

Q-3. Would you recommend this training course to others as a way of learning WordPerfect?

1 DEFINITELY
2 PROBABLY
3 NOT SURE
4 PROBABLY NOT
5 DEFINITELY NOT

Q-4. How much do you think you will use WordPerfect in your job? (Circle number)

________ HOURS and ________ MINUTES

Q-5. How frequently do you think you will use WordPerfect? (Circle number)

1 SEVERAL TIMES A DAY
2 ABOUT ONCE A DAY
3 A FEW TIMES A WEEK
4 A FEW TIMES A MONTH
5 ONCE A MONTH
6 LESS THAN ONCE A MONTH

Q-6. Please evaluate the Lotus 1-2-3 training on each of the following dimensions:

(a) Was the Lecture/Demonstration:

1	2	3	4	5
HELPFUL				NOT HELPFUL

(b) Were the Training Notes (the notes in the binders):

1	2	3	4	5
HELPFUL				NOT HELPFUL
1	2	3	4	5
WELL PRODUCED				POORLY PRODUCED
1	2	3	4	5
EASY TO FOLLOW				HARD TO FOLLOW

(c) Were the Practice Exercises:

1	2	3	4	5
HELPFUL				NOT HELPFUL
1	2	3	4	5
WELL PRODUCED				POORLY PRODUCED
1	2	3	4	5
EASY TO FOLLOW				HARD TO FOLLOW

(d) Was the Videotape:

1	2	3	4	5
HELPFUL				NOT HELPFUL
1	2	3	4	5
WELL PRODUCED				POORLY PRODUCED

What, if anything, did you learn from the videotape?

(e) Overall, how would you rate the Lotus 1-2-3 training?

1	2	3	4	5
HELPFUL				NOT HELPFUL

Q-7. Please indicate the extent to which you believe the Lotus 1-2-3 training helped you become competent at using the software.

1	2	3	4	5
TO A VERY LITTLE EXTENT		TO SOME EXTENT		TO A VERY GREAT EXTENT

Q-8. Would you recommend this training course to others as a way of learning Lotus 1-2-3?

1 DEFINITELY
2 PROBABLY
3 NOT SURE
4 PROBABLY NOT
5 DEFINITELY NOT

Q-9. How much do you think you will use Lotus 1-2-3 in your job? (Circle number)

________ HOURS and ________ MINUTES

Q-10. How frequently do you think you will use Lotus 1-2-3? (Circle number)

1 SEVERAL TIMES A DAY
2 ABOUT ONCE A DAY
3 A FEW TIMES A WEEK
4 A FEW TIMES A MONTH
5 ONCE A MONTH
6 LESS THAN ONCE A MONTH

SECTION B

The following statements describe the outcomes that people might experience as a result of using a computer. For each item indicate whether you feel you would be likely to experience that outcome from your computer use.

IF I USE A COMPUTER...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-11.	...I will be better organized......	.1	2	3	4	5
Q-12.	...my co-workers will perceive me as competent......................	.1	2	3	4	5
Q-13.	...I will increase my sense of accomplishment....................	.1	2	3	4	5
Q-14.	...I will increase my chances of obtaining a promotion..............	.1	2	3	4	5
Q-15.	...I will increase my effectiveness on the job.........................	.1	2	3	4	5
Q-16.	...I will be seen as higher in status by my peers.................	.1	2	3	4	5
Q-17.	...I will increase my chances of getting a raise....................	.1	2	3	4	5
Q-18.	...I will spend less time on routine job tasks.................	.1	2	3	4	5
Q-19.	...I will increase the quality of output of my job..................	.1	2	3	4	5
Q-20.	...I will increase the quantity of output for the same amount of effort............................	.1	2	3	4	5
Q-21.	...I will be less reliant on clerical support staff............	.1	2	3	4	5

Now consider the probable outcomes of using specifically WordPerfect. For each of the following items, please indicate whether you feel you would be likely to experience that outcome from your use of WordPerfect.

IF I USE WORDPERFECT...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-22.	...I will be better organized......	.1	2	3	4	5
Q-23.	...my co-workers will perceive me as competent......................	.1	2	3	4	5
Q-24.	...I will increase my sense of accomplishment....................	.1	2	3	4	5
Q-25.	...I will increase my chances of obtaining a promotion..............	.1	2	3	4	5
Q-26.	...I will increase my effectiveness on the job.........................	.1	2	3	4	5
Q-27.	...I will be seen as higher in status by my peers.................	.1	2	3	4	5
Q-28.	...I will increase my chances of getting a raise....................	.1	2	3	4	5
Q-29.	...I will spend less time on routine job tasks..................	.1	2	3	4	5
Q-30.	...I will increase the quality of output of my job..................	.1	2	3	4	5
Q-31.	...I will increase the quantity of output for the same amount of effort...........................	.1	2	3	4	5
Q-32.	...I will be less reliant on clerical support staff.............	.1	2	3	4	5

Now consider the probable outcomes of using specifically Lotus 1-2-3. For each of the following items, please indicate whether you feel you would be likely to experience that outcome from your use of Lotus 1-2-3.

IF I USE LOTUS 1-2-3...

		VERY UNLIKELY		NEUTRAL		VERY LIKELY
Q-33.	...I will be better organized......	1	2	3	4	5
Q-34.	...my co-workers will perceive me as competent......................	1	2	3	4	5
Q-35.	...I will increase my sense of accomplishment.....................	1	2	3	4	5
Q-36.	...I will increase my chances of obtaining a promotion..............	1	2	3	4	5
Q-37.	...I will increase my effectiveness on the job........................	1	2	3	4	5
Q-38.	...I will be seen as higher in status by my peers.................	1	2	3	4	5
Q-39.	...I will increase my chances of getting a raise....................	1	2	3	4	5
Q-40.	...I will spend less time on routine job tasks.................	1	2	3	4	5
Q-41.	...I will increase the quality of output of my job..................	1	2	3	4	5
Q-42.	...I will increase the quantity of output for the same amount of effort............................	1	2	3	4	5
Q-43.	...I will be less reliant on clerical support staff.............	1	2	3	4	5

The next few statements describe feelings that some people have about computers. For each statement, please indicate the extent to which you agree or disagree with the feelings being expressed.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-44.	I like working with computers..........	1	2	3	4	5
Q-45.	I look forward to those aspects of my job that require me to use a computer..	1	2	3	4	5
Q-46.	Once I start working on the computer, I find it hard to stop.................	1	2	3	4	5
Q-47.	Using a computer is frustrating for me.	1	2	3	4	5
Q-48.	I get bored quickly when working on a computer..............................	1	2	3	4	5

The next few items concern your opportunity to use WordPerfect and Lotus 1-2-3 in your current job. Pease indicate the extent to which you agree or disagree with each of the following statements.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-49.	I have the opportunity to use WordPerfect in my current job..........	1	2	3	4	5
Q-50.	Using WordPerfect is important for my job..................................	1	2	3	4	5
Q-51.	The skills that I will learn in WordPerfect training will be immediately useful to me in my job.....	1	2	3	4	5
Q-52.	I have the opportunity to use Lotus 1-2-3 in my current job................	1	2	3	4	5
Q-53.	Using Lotus 1-2-3 is important for my job..................................	1	2	3	4	5
Q-54.	The skills that I will learn in Lotus 1-2-3 training will be immediately useful to me in my job................	1	2	3	4	5

SECTION C

This part of the questionnaire asks you about your ability to use an unfamiliar piece of software. Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

		NOT AT ALL CONFIDENT	MODERATELY CONFIDENT	TOTALLY CONFIDENT
...if there was someone giving me step by step instructions.	[✓ YES].... NO	1 2 3	4 [✓ 5] 6 7 8	9 10

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so.

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

NOT AT ALL CONFIDENT
MODERATELY CONFIDENT
TOTALLY CONFIDENT

Q-55.	...if there was no one around to tell me what to do as I go.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-56.	...if I had only the software manuals for reference.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-57.	...if I had seen someone else using it before trying it myself.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-58.	...if I could call someone for help if I got stuck.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-59.	...if someone else had helped me get started.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-60.	...if I had a lot of time to complete the job for which the software was provided.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-61.	...if I had just the built-in help facility for assistance.	YES.....1 2 3 4 5 6 7 8 9 10 NO
Q-62.	...if someone showed me how to do it first.	YES.....1 2 3 4 5 6 7 8 9 10 NO

Now consider specifically WordPerfect. The following questions ask you to indicate whether you think you could use WordPerfect under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using WordPerfect. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING WORDPERFECT...

			NOT AT ALL CONFIDENT				MODERATELY CONFIDENT					TOTALLY CONFIDENT
Q-63.	...if there was no one around to tell me what to do as I go.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-64.	...if I had only the software manuals for reference.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-65.	...if I had seen someone else using it before trying it myself.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-66.	...if I could call someone for help if I got stuck.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-67.	...if someone else had helped me get started.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-68.	...if I had a lot of time to complete the job for which the software was provided.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-69.	...if I had just the built-in help facility for assistance.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-70.	...if someone showed me how to do it first.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										

Now consider specifically Lotus 1-2-3. The following questions ask you to indicate whether you think you could use Lotus 1-2-3 under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using Lotus 1-2-3. Then, for each condition that you answered "yes", please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident", and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING LOTUS 1-2-3...

			NOT AT ALL CONFIDENT			MODERATELY CONFIDENT					TOTALLY CONFIDENT	
Q-71.	...if there was no one around to tell me what to do as I go.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-72.	...if I had only the software manuals for reference.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-73.	...if I had seen someone else using it before trying it myself.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-74.	...if I could call someone for help if I got stuck.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-75.	...if someone else had helped me get started.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-76.	...if I had a lot of time to complete the job for which the software was provided.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-77.	...if I had just the built-in help facility for assistance.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										
Q-78.	...if someone showed me how to do it first.	YES.....	1	2	3	4	5	6	7	8	9	10
		NO										

SECTION D

This section of the questionnaire asks about your feelings towards using computers. The following statements reflect various feelings towards using computers that you may or may not hold. For each statement, please indicate the extent to which you agree or disagree with the feelings expressed.

Please circle your response.

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-79.	I feel insecure about my ability to interpret a computer printout	1	2	3	4	5
Q-80.	I look forward to using a computer on my job	1	2	3	4	5
Q-81.	I do not think I would be able to learn a computer programming language	1	2	3	4	5
Q-82.	The challenge of learning about computers is exciting	1	2	3	4	5
Q-83.	I am confident that I can learn computer skills	1	2	3	4	5
Q-84.	Anyone can learn to use a computer if they are patient enough	1	2	3	4	5
Q-85.	Learning to operate computers is like learning any new skill - the more you practice, the better you become	1	2	3	4	5
Q-86.	I am afraid that if I use computers I will become dependent on them and lose some of my reasoning skills	1	2	3	4	5
Q-87.	I feel computers are necessary tools in educational settings	1	2	3	4	5

		STRONGLY DISAGREE		NEITHER AGREE NOR DISAGREE		STRONGLY AGREE
Q-88.	I feel that I will be able to keep up with the advances happening in the computer field	1	2	3	4	5
Q-89.	I dislike working with machines that are smarter than I am	1	2	3	4	5
Q-90.	I feel apprehensive about using computers	1	2	3	4	5
Q-91.	I have difficulty in understanding the technical aspects of computers	1	2	3	4	5
Q-92.	It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key	1	2	3	4	5
Q-93.	I hesitate to use a computer for fear of making mistakes that I cannot correct	1	2	3	4	5
Q-94.	You have to be a genius to understand all the special keys contained on most computer terminals	1	2	3	4	5
Q-95.	If given the opportunity, I would like to learn more about computers	1	2	3	4	5
Q-96.	Computers are somewhat intimidating to me	1	2	3	4	5
Q-97.	I feel computers are necessary tools in work settings	1	2	3	4	5
Q-98.	I am sure that with time and practice I will be as comfortable working with computers as I am in working a typewriter	1	2	3	4	5

Thank you very much for your assistance!

Please return the completed questionnaire in the envelope provided to:

Debbie Compeau
Project Co-ordinator
Computer Learning Study
School of Business Administration
The University of Western Ontario
London, Ontario
N6A 3K7

If you have any further questions, please call me at 679-2111 ext. 4544.

APPENDIX T

FACTOR ANALYSES

OF

OUTCOME EXPECTATIONS

Results of Factor Analysis

- Principal Components Factor Analysis, Varimax Rotation
- General Outcome Expectations, Background Questionnaire only

One Factor Solution

Rotated Factor Structure Matrix

Item	Loading
BGOUT1	0.470
BGOUT2	0.453
BGOUT3	0.370
BGOUT4	0.480
BGOUT5	0.739
BGOUT6	0.578
BGOUT7	0.526
BGOUT8	0.518
BGOUT9	0.689
BGOUT10	0.668
BGOUT11	0.469
Explained Variance	30.5%

Two Factor Solution

Rotated Factor Structure Matrix

Item	Factor 1 Loading	Factor 2 Loading
BGOUT1	0.481	0.035
BGOUT2	0.040	0.604
BGOUT3	0.156	0.295
BGOUT4	-0.008	0.766
BGOUT5	0.720	0.209
BGOUT6	0.141	0.690
BGOUT7	0.073	0.733
BGOUT8	0.592	-0.029
BGOUT9	0.751	0.100
BGOUT10	0.711	0.085
BGOUT11	0.402	0.131
Explained Variance	60.3%	36.0%

Three Factor Solution

Rotated Factor Structure Matrix

Item	Factor 1 Loading	Factor 2 Loading	Factor 3 Loading
BGOUT1	0.504	0.066	-0.028
BGOUT2	-0.039	0.400	0.545
BGOUT3	0.082	0.119	0.424
BGOUT4	0.027	0.791	0.135
BGOUT5	0.707	0.148	0.206
BGOUT6	0.082	0.522	0.500
BGOUT7	0.123	0.788	0.073
BGOUT8	0.562	-0.107	0.175
BGOUT9	0.772	0.115	0.031
BGOUT10	0.699	0.035	0.154
BGOUT11	0.303	-0.093	0.489
Explained Variance	60.3%	36.0%	12.9%

REFERENCES

Alavi, M., & Henderson, J. C. (1981). An evolutionary strategy for implementing a decision support system. Management Science, 27(11), 1309-1323.

Armstrong, J. S., & Overton, T. S. (1977). Estimating non-response bias in mail surveys. Journal of Marketing Research, 14, 396-402.

Bagozzi, R. P. (1984). A prospectus for theory construction in marketing. Journal of Marketing, 48(Winter 1984), 11-29.

Bailey, J. E., & Pearson, S. W. (1983). "Development of a tool for measuring and analyzing computer user satisfaction." Management Science, 29(6), 519-529.

Bandura, A. (1971). Influence of models' reinforcement contingencies on the acquisition of imitative responses. In A. Bandura (Ed.), Psychological modeling: Conflicting theories (pp. 112-127). Chicago: Aldine/Atherton.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215.

Bandura, A. (1978). Reflections on self-efficacy. Advances in Behavioral Research and Therapy, 1, 237-269.

Bandura, A. (1982). Self-efficacy mechanism in human agency. American Psychologist, 372, 122-147.

Bandura, A. (1984). Recycling misconceptions of perceived self-efficacy. Cognitive Therapy and Research, 8(3), 231-255.

Bandura, A. (1986). Social foundations of thought and action, Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A., Adams, N. E., & Beyer, J. (1977). Cognitive processes mediating behavioral change. Journal of Personality and Social Psychology, 35(3), 125-139.

Bandura, A., Adams, N. E., Hardy, A. B., & Howells, G. N. (1980). Tests of the generality of self-efficacy theory, Cognitive Therapy and Research, 4(1), 39-60.

Bandura, A., & Barab, P. G. (1973). Processes governing disinhibitory effects through symbolic modeling. Journal of Abnormal Psychology, 82, 1-9.

Bandura, A., & Schunk, D. H. (1981). Cultivating competence, seif-efficacy, and intrinsic interest through proximal self-motivation. Journal of Personality and Social Psychology, 41(3), 586-598.

Bandura, A., Taylor, C. B., Williams, S. L., Mefford, I. N., & Barchas, J. D. (1985). Catecholamine secretion as a function of perceived coping self-efficacy. Journal of Consulting and Clinical Psychology, 53(3), 406-414.

Barki, H., & Huff, S. L. (1990). Implementing decision support systems: Correlates of user satisfaction and system usage. INFOR, 28(2), 89-101.

Barling, J., & Beattie, R. (1983). Self-efficacy beliefs and sales performance. Journal of Organizational Behavior Management, 5, 41-51.

Baronas, A. K., & Louis, M. R. (1988). Restoring a sense of control during implementation: How user involvement leads to system acceptance. MIS Quarterly, 12(1), 111-123.

Baroudi, J. J., Olson, M. H., & Ives, B. (1986). "An empirical study of the impact of user involvement on system usage and information satisfaction." Communications of the ACM, 29(3), 232-238.

Betz, N.E., & Hackett, G. (1981). The relationships of career-related self-efficacy expectations to perceived career options in college women and men. Journal of Counseling Psychology, 28, 399-410.

Bostrom, R. P., Olfman, L., & Sein, M. (1990). The importance of learning style in end-user training. MIS Quarterly, 14(1), 101-119.

Brancheau, J. C., & Wetherbe, J. C. (1987). Key issues in information systems management. MIS Quarterly, 11(1), 23-45.

Brancheau, J. C., & Wetherbe, J. C. (1990). The adoption of spreadsheet software: Testing innovation diffusion theory in the context of end-user computing. Information Systems Research, 1(2), 115-143.

Brief, A. P. & Aldag, R. J. (1981). The 'self' in work organizations: A conceptual review. Academy of Management Review, 6(1), 75-88.

Brown, I., Jr., & Inouye, D. K. (1978). Learned helplessness through modeling: The role of perceived similarity in competence. Journal of Personality and Social Psychology, 36, 900-908.

Burke, M. J., & Day, R. R. (1986). A cumulative study of the effectiveness of managerial training. Journal of Applied Psychology, 71, 232-245.

Burkhardt, M. E., and Brass, D. J. (1990). Changing patterns or patterns of change: The effects of a change in technology on social network structure and power. Administrative Science Quarterly, 35, 104-127.

Byham, W. C., Adams, D., & Kiggins, A. (1976). Transfer of modelling training to the job, Personnel Psychology, 29, 345-349.

Clemons, E. K., & Row, M. (1988). McKesson drug company: A case study of economost - A strategic information system. Journal of Management Information Systems, 5(1), 36-50.

Collins, J. L. (1985). Self-efficacy and ability in achievement behavior. Unpublished doctoral dissertation, Stanford University.

Condiotte. M., & Lichenstein, E. (1981). Self-efficacy and relapse in smoking cessation programs, Journal of Consulting and Clinical Psychology, 49, 648-658.

Cook, T. D., and & Campbell, D. T. (1979). Quasi-experimentation: Design and analysis for field studies. Boston: Houghton-Mifflin.

Copeland, D. G., & McKenney, J. L. (1988). Airline reservations systems: Lessons from history. MIS Quarterly 12(3), 353-370.

Davis, B. L., & Mount, M. K. (1984). Effectiveness of performance appraisal training using computer assisted instruction and behavior modeling. Personnel Psychology, 37, 439-451.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science, 35(8), 982-1003.

Davis, S., & Bostrom, R. P. (1990). Training end-users to compute: An experimental investigation of the roles of the computer interface and training methods (Working Paper # 50). Athens, GA: The University of Georgia.

Davis, T. R. V., & Luthans, F. (1980). A social learning approach to organizational behavior. Academy of Management Review, 5, 281-290.

Decker, P.J. (1980). Effects of symbolic coding and rehearsal in behavior-modeling training. Journal of Applied Psychology, 65, 627-634.

Delone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. Information Systems Research, 3(1), 60-95.

DeSanctis, G. (1983). Expectancy theory as an explanation of voluntary use of a decision support system. Psychological Reports, 52, 247-260.

DiClemente, C. C. (1981). Self-efficacy and smoking cessation maintenance: a preliminary report. Cognitive Therapy and Research, 5, 175-187.

Dillon, P. C., Graham, W. K., & Aidells, A. L. (1972). Brainstorming on a 'hot' problem: Effects of training and practice on individual and group performance. Journal of Applied Psychology, 56(6), 487-490.

Engle, J. F., Blackwell, R. D., & Miniard, P. W. (1986). Consumer behavior (fifth ed.). New York: Holt, Rinehart and Winston.

Fishbein, M. & Ajzen, I. (1975). Belief, attitude, intention and behavior: An introduction to theory and research. Reading, Mass: Addison-Wesley.

Fornell, C. (1984). A second generation of multivariate analysis: Classification of methods and implications for marketing research (Working Paper). Ann Arbor, MI: The University of Michigan.

Frayne, C. A. (1986). The application of social learning theory to employee self-management of attendance. Unpublished doctoral dissertation, University of Washington, Seattle.

Frayne, C. A., & Latham, G. P. (1987). The application of social learning theory to employee self-management of attendance. Journal of Applied Psychology, 72, 387-92.

Fuerst, W. L., & Cheney, P. H. (1982). Factors affecting the perceived utilization of computer-based decision support systems in the oil industry. Decision Sciences, 13, 554-569.

Gallo, D. D. (1986). Expectancy theory as a predictor of individual response to computer technology. *Computers in Human Behavior*, *2*, 31-41.

Ginzberg, M. J. Key recurrent issues in the MIS implementation process." *MIS Quarterly*, *5*(2), 47-59.

Gist, M. E. (1986). The effects of self-efficacy on training task performance. *Academy of Management Best Paper Proceedings*, 250-254.

Gist, M. E. (1987). Self-efficacy: Implications for organizational behavior and human resource management. *Academy of Management Review*, *12*(3), 472-485.

Gist, M. E., & Mitchell, T. R. (1992). Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management Review*, *17*(2), 183-211.

Gist, M. E., Schwoerer, C. E., & Rosen, B. (1989). Effects of alternative training methods on self-efficacy and performance in computer software training. *Journal of Applied Psychology*, *74*, 884-891.

Goldstein, A. P., & Sorcher, M. (1974). *Changing supervisor behavior*, New York: Pergamon Press.

Guidice, G. P. (1990). Making the most of CMM. *PEM: Plant Engineering and Maintenance*, 30-32. (From ABI/Inform, 1990, Abstract No. 90-13365).

Heinssen, R. K., Glass, C. R., & Knight, L. A. (1987). Assessing computer anxiety: Development and validation of the computer anxiety rating scale. *Computers and Human Behavior*, *3*, 49-59.

Hill, T., Smith, N. D., & Mann, M. F. (1986). Communicating innovations: Convincing computer phobics to adopt innovative technologies" In R. J. Lutz (Ed.), *Advances in Consumer Research*, (Vol. 13, pp. 419-422). Provo, UT: Association for Consumer Research.

Hill, T., Smith, N. D., & Mann, M. F. (1987). Role of efficacy expectations in predicting the decision to use advanced technologies: The case of computers. *Journal of Applied Psychology*, *72*(2), 307-313.

Hopper, M. D. (1990) Rattling SABRE: New ways to compete on information. *Harvard Business Review*, *68*, May-June, 118-125.

Igbaria, M. (1990) End-user computing effectiveness: A structural equation model. OMEGA International Journal of Management Science, 18(6), 637-652.

Igbaria, M., Pavri, F. N., & Huff, S. L. (1989). Microcomputer applications: An empirical look at usage. Information and Management, 16. 187-196.

Ives, B., Olson, M., and Baroudi, J. (1983). "The measurement of user information satisfaction." Communications of the ACM, 26(10), 785-793.

Latham, G. P., & Saari, L. M. (1979). Application of social-learning theory to training supervisors through behavioral modeling. Journal of Applied Psychology, 64(3), 239-246.

Leonard-Barton, D., & Deschamps, I. (1988). Managerial influence in the implementation of new technology. Management Science, 34(10), 1252-1265.

Lewis, C. (1990). Microcomputer training demands targeted attention. Savings Institutions, 111(4), 53. (From ABI/Inform, 1990, Abstract No. 90-16535).

Locke, E. A., Frederick, E., Lee, C., & Bobko, P. (1984). Effect of self-efficacy, goals, and task strategies on task performance. Journal of Applied Psychology, 69(2), 241-251.

Lohmöller, J. B. (1988). The PLS program system: Latent variables path analysis with partial least squares estimation. Multivariate Behavioral Research, 23, 125-127.

Loyd, B. H., & Gressard, C. (1984). Reliability and factorial validity of computer attitude scales. Educational and Psychological Measurement, 44, 501-505.

Lucas, H. C., Jr. (1974). Systems quality, user reactions and the use of information systems. Management Informatics, 3(4), 207-212.

Lucas. H. C., Jr. (1975a). Behavioral factors in system implementation. In R. L. Schultz & D. P. Slevin (Eds.) Implementing operations research/management science. New York: American Elsevier.

Lucas, H. C., Jr. (1975b) Performance and the use of an information system. Management Science, 21(8), 908-919.

Lucas, H. C., Jr. (1978). Empirical evidence for a descriptive model of implementation. MIS Quarterly, 2(2), 27-41.

Maish, A. M. (1979). A user's behavior toward his MIS. MIS Quarterly, 3(1), 39-52.

Mann, R. B., & Decker, P. J. (1984). The effect of key behavior distinctiveness on generalization and recall in behavior modeling training. Academy of Management Journal, 27, 900-909.

Manz, C. C., & Sims. H. P. (1986). Beyond imitation: Complex behavioral and affective linkages resulting from exposure to leadership training models. Journal of Applied Psychology, 71, 571-578.

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. Information Systems Research, 2(3), 173-191.

Meichenbaum, D.H. (1971). Examination of model characteristics in reducing avoidance behavior. Journal of Personality and Social Psychology, 17, 298-307.

Meyer, H. H., & Raich, M. S. (1983). An objective evaluation of a behavior modeling training program. Personnel Psychology, 36, 755-761.

Monsalve, M. A., & Triplett, A. (1990). Maximizing new technology. HR Magazine, 35(3), 85-87. (From ABI/Inform, 1990, Abstract No. 90-14360).

Montazemi, A. R. (1988). Factors affecting information satisfaction in the context of the small business environment. MIS Quarterly, 12(2), 239-256.

Moore, G. C. (1989). An examination of the implementation of information technology for end users: A diffusion of innovations perspective. Unpublished doctoral dissertation, The University of British Columbia, Vancouver.

Moses, J. L, & Ritchie, R. J. (1976). Supervisory relationships training: A behavioral evaluation of a behavior modelling program. Personnel Psychology, 29, 337-343.

Nelson, R. R., & Cheney, P. H. (1987b). Training end users: An exploratory study", MIS Quarterly, 11(4), 547-559.

Nunnally, J. C. (1978). Psychometric theory. New York: McGraw-Hill.

Oberle, J. (1990). Manpower Inc. - Training because there's no other way. Training, 27(3), 57-62. (From ABI/Inform, 1990, Abstract No. 90-15464).

Olfman, L., & Bostrom, R. P. (1990). End-user software training: An experimental comparison of methods to enhance motivation (Working Paper 02-90). Claremont, CA: The Claremont Graduate School, Information Science Applications Center.

Pavri, F. N. (1988). A study of the factors contributing to microcomputer usage. Unpublished doctoral dissertation, The University of Western Ontario, London.

Pedhazur, E. J. (1982). Multiple regression in behavioral research. New York: Holt, Rinehart & Winston.

Pennefather, S. (1989). Key to productivity. Computerdata, 14(7), 16-17.

Porter, L. W., & Lawler, E. E. (1968). Managerial attitudes and performance. Homewood, Ill.: Irwin.

Raymond, L. (1988). The impact of computer training on the attitudes and usage behavior of small business managers. Journal of Small Business Management, 26, 8-13.

Raymond, L., Bergeron, F., & Bedard, M. (1990). Application, task and user-related factors of personal DSS success: An exploratory study in the context of small business. Proceedings of the Administrative Science Association of Canada Conference (IS Division), Whisler, B.C.

Redkey, S. (1990). The benefits of backscratching. Computerworld, 24(9), 103. (From ABI/Inform, 1990, Abstract No. 90-11361).

Reich, B. H., & Benbasat, I. (1990). An empirical investigation of factors influencing the success of customer-oriented strategic systems. Information Systems Research, 1(3), 325-347.

Robey, D. (1979). User attitudes and management information system use. Academy of Management Journal, 22(3), 527-538.

Rogers, E. M. (1983). Diffusion of innovations. New York: Free Press.

Runge, D. A. (1988). Winning with telecommunications: An approach for corporate strategists. Washington: International Center for Information Technology.

Sanders, G. L., & Courtney, J. F. (1985). A field study of organizational factors influencing DSS success. MIS Quarterly, 9(1), 77-89.

Schewe, C. D. (1976). The management information system user: An exploratory behavioral analysis. Academy of Management Journal, 19(4), 577-590.

Schunk, D. H. (1981). Modeling and attributional effects on children's achievement: A self-efficacy analysis. Journal of Educational Psychology, 73, 93-105.

Sein, M. K., & Bostrom, R. P. (1989). Individual differences and conceptual models in training novice users. Human-Computer Interaction, 4, 197-229.

Shulman, R. E. (1990). Designing systems for greater usability. Supermarket Business, 44(12), 13-15,58. (From ABI/Inform, 1990, Abstract No. 90-08736).

Stumpf, S. A., Brief, A. P., & Hartman, K. (1987). Self-efficacy expectations and coping with career-related events. Journal of Vocational Behavior, 31, 91-108.

Tait, P., & Vessey, I. (1988). The effect of user involvement on system success: A contingency approach. MIS Quarterly, 12(1), 91-108.

Taylor, M. S., Locke, E. A., Lee, C. & Gist, M. E. (1989). Type A behavior and faculty research productivity: What are the mechanisms. Organizational Behavior and Human Performance, 34, 402-418.

Tannenbaum, S. I. (1990). Human resource information systems: User group implications. Journal of Systems Management, 41(1) 27-32. (From ABI/Inform, 1990, Abstract No. 90-07300).

Thompson, R. L.; Higgins. C. A.; and Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. MIS Quarterly, 15(1), 125-143.

Triandis, H. C. (1980). Values, attitudes, and interpersonal behavior. In M. M. Page (Ed.) Nebraska symposium on motivation 1979 - Beliefs, attitudes and values. Lincoln, NB: University of Nebraska Press, 195-260.

Vroom, V. H. (1964). Work and motivation. New York: John Wiley & Sons.

Warner, L., & Smith, T. (1990). Computer training: Necessity not luxury. Management Accounting (UK), 68(3), 48. (From ABI/Inform, 1990, Abstract No. 90-18206).

Webster, J., Heian, J. B., & Michelman, J. E. (1990). Mitigating the effects of computer anxiety through training. Unpublished paper, The Pennsylvania State University.

Webster, J., & Martocchio, J. J. (1990). A construct validity assessment of a computer playfulness measure. Unpublished paper, The Pennsylvania State University.

Webster, J., & Martocchio, J. J. (in press). Turning work into play: Implications for microcomputer software training. Journal of Management.

Wiseman, C. (1985). Strategy and computers: Information systems as competitive weapons. Homewood, Il: Dow Jones Irwin.

Wood, R., & Bandura, A. (1989). Social cognitive theory of organizational management. Academy of Management Review, 14(3), 361-384.

Wold, H. (1985). Systems analysis by partial least squares. In P. Nijkamp, H. Leitner, & N. Wrigley (Eds.) Measuring the unmeasurable. Boston: Martinus Nijhoff Publishers.

Zmud, R. W. (1980). "The role of individual differences in MIS implementation success." Symposium on MIS implementation research. Proceedings of the 12th Annual Meeting of the American Institute for Decision Sciences, 1, 215.