

**THE IMPORTANCE OF INDIVIDUAL DIFFERENCES IN DEVELOPING
COMPUTER TRAINING PROGRAMS FOR END USERS**

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Abstract

Research emphasises that effective and efficient end-user training is a vital component of the successful utilization of computer technology and that individual differences (e.g., learning styles, cognitive reasoning schemata) may effect the outcomes of end-user training. This study investigates the relationships between end users' **MOTIVATIONAL INTENT** to use computer technology and individual differences. End users' **MOTIVATIONAL INTENT** to use computer technology is significantly different for between-subjects grouped according to their level of anxiety (i.e., positive, neutral, negative). The empirical results indicate that end users' *scholastic ability* is an important predictor of the incremental change over time to end users' **MOTIVATIONAL INTENT** to use computer technology. End users' *learning styles* impact the incremental change over time to end users' **MOTIVATIONAL INTENT** to use computer technology. The results suggest that the tailoring of end-user training methods, techniques and materials to accommodate individual differences may be beneficial and worthwhile.

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Chapter 1: Introduction

During the past two decades industrialized countries have witnessed a rapid evolution in, and the adoption of, computer technology best described as ubiquitous, multifarious, multiform and complex. At present, the same countries are witnessing the development of the "information super-highway." In today's global economy, organizations (e.g., businesses, governments, non-profit entities) depend upon the successful utilization of computer technology to maintain and/or gain a competitive advantage (Brancheau & Wetherbe, 1987; Nelson, 1991). Approximately 25% of the microcomputers sold are not used because end users are not computer literate and do not learn how to use computer technology (Bagozzi, Davis & Warshaw, 1992). One possible reason why computer technology is under utilized in organizations (Davis, Bagozzie, & Warshaw, 1989) is that the amount of money spent on training end users constitutes less than 2% of the expenditures by Information Systems (IS) departments (Nelson & Cheney, 1987).

The rapid development of computer hardware and software and the insatiable demand for software result in the need for continuous learning by the end user (Niederman, Brancheau, & Wetherbe, 1991) and the demand for effective and efficient end-user training. This creates problems for organizations and educational institutions because the introduction of new software and/or hardware means that each end user must start either a new learning curve (Niederman et al., 1991) or a

refined learning curve. Consequently, employees will require retraining at least five to eight times during their careers (Wexley, 1984). The ultimate purpose of end-user training or retraining, therefore, is to provide a background for trainees to transfer their acquired knowledge about computers to the workplace and to further develop the necessary skills required to perform a variety of computer-related tasks (Nelson & Cheney, 1987).

Another area of concern and alarm for Canadians, politicians, managers, and educators is a conclusion outlined in a Canadian statistical study (see Appendix A for Canadian trends and statistics) which concluded that:

These findings [e.g., certain socio-demographic factors, for example, age, high household income, and post-secondary education, were indicators of computer ownership and/or computer literacy] lend credence to the view that computer technology was an emergent source of inequality in Canadian society. Computer skills, or computer literacy, can confer human capital advantages in schools or in the workplace. Existing social inequalities thus could be accentuated if the better-educated and more affluent are the ones mainly benefitting from computer technology. (Lowe, 1990, p. 78-79).

It is apparent that end-user training is an escalating economical and societal issue. In order for all participants

in today's computing environment (e.g., government, end users, management, unions, educators) to obtain maximum utility of computer technology, effective and efficient computer training programs, which develop competent levels of end-user knowledge¹, skills² and motivation to use computers, must be designed.

Problem

Niederman et al. (1991) indicate that before the business community and educational systems can utilize effectively and efficiently computer technology, research needs to be directed at factors which contribute to training outcomes. Specifically, the relationships between learning performance and end users' perceptions of the system (e.g., motivation to use computer technology), and how the trainer/instructor can facilitate learning by the end user need to be determined. Research indicates that three groups of factors effect the outcomes of end-user training: target systems and interface, the type of training method, and specified characteristics (i.e., individual differences) of the end users (Bostrom, Olfman, & Sein, 1990; Davis & Bostrom, 1993; Sein, Bostrom, & Olfman, 1987). Davis and Bostrom (1993) state that an

¹ Knowledge has been categorized as declarative knowledge and procedural knowledge. Gattiker (1990) defined declarative knowledge as "knowledge about something" (p. 298) and procedural knowledge as "knowledge about how to do something" (p. 302).

² Computer skills are defined as learned behaviours which are required to perform computer related tasks at a particular performance level (Gattiker, 1992, p. 70).

effective training program, either advanced or basic, is the principle antecedent to the successful, effective, and efficient use of computer technology.

An extensive literature review indicates that an empirical study examining the relationships and effects of a comprehensive group of individual differences on training outcomes (e.g., learning performance and positive perception about computer technology) does not appear to exist. Therefore, this thesis explores the relationships between specified individual differences and the attitudinal change over time of end users' motivational intent to use computer technology (one of the outcomes of end-user training). Specifically, this paper investigates (1) different types of learning styles (cognitive traits component of individual differences) and the manner in which they relate to and effect end users' motivational intent to use computer technology and the incremental change over time to end users' motivational intent to use computer technology; (2) different types of reasoning skills (structures-strategies component of individual differences) and their relationship with and their effect upon end users' motivational intent to use computer technology and the incremental change over time to end users' motivational intent to use computer technology; and (3) whether specific descriptive traits of end users (e.g., gender, age, scholastic ability [defined as a priori grade point average], and previous computer experience) and a states

component of individual differences (i.e., an end user's level of anxiety about computer technology) are important predictors of the incremental change over time to end users' motivational intent to use computer technology.

Purpose

This thesis will provide computer designers, educators, trainers and managers with preliminary information that will facilitate the development and design of better computer training programs for end users. The development of effective and efficient end-user training programs will generate a multitude of benefits, both economic and social, for all constituents utilizing computer technology. When employees acquire a proficient level of computer skills, companies will derive maximum benefit from their financial investments in computer technology and maintain and/or gain a competitive advantage (Gattiker, 1992). Organizations will experience a reduction in on-the-job training costs because employees who receive effective training will transfer more effectively their acquired computer skills to the workplace and they will be more motivated to accept and adopt computer technology in the workplace. End users will also benefit when training programs/courses are better directed to their needs. Post-secondary institutions will benefit by graduating students with computer skills that are better tailored to their specific career goals and are transferable to the work environment. As a result, organizations' initial training

costs related to computer technology are reduced because trained, entry-level personnel are available in the workforce. Post-secondary students will benefit when academic counsellors and admission officers are better able to advise these students whether their academic choices are realistic (Campbell & McCabe, 1984). Finally, society, as a whole, will benefit from the development of proficient and effective computer training programs if a potential source of individual inequality can be limited.

Chapter 2: Literature Review

End-user computer training attracted considerable attention and energy from the education, management, MIS, and psychology research communities during the last two decades. A large body of related interdisciplinary literature examined why end-user training was important (Brancheau & Wetherbe, 1987; Davis et al., 1989; Davis & Bostrom, 1993; Niederman et al., 1991), but very little empirical research exists which investigated the effects and relationship between a comprehensive group of individual differences and end users' motivational intent to use computer technology.

Research indicated that computer trainees experience many conceptual and operational problems (Bostrom et al., 1990; Davis & Bostrom, 1993) and inefficacious learning (Carroll, 1984) because of inappropriate and ineffective training programs. Carroll (1984) reported that commercial introductory and advanced computer manuals, and computer-training manuals created frustration for end users. Carroll and Mazur (1986) concluded that end users experienced difficulty when trying to apply a software package to a specific task. Research reported that end users tended to overextend their non-computer experience to computer systems (Davis & Bostrom, 1993). End users experienced difficulty utilizing and remembering syntax commands (Borgman, 1986). The consequences of inappropriate and ineffective instructional and/or training programs were that students

and/or trainees were frustrated, overwhelmed, and confused (Carroll, 1984), and lagged behind their counterparts because they had not mastered basic computer skills (Vockell, 1990).

Perceptions/Attitudes

Research provided support for the premise that perception/attitude influenced an end user's motivational intent to use computer technology. Pratkanis (1989) reported that individuals' attitudes were reliable indicators of how people comprehend their society and were important predictors of their conceptual cognitive processes. Research provided evidence that end users' perceptions of computer technology were heterogeneous and individualistic (Rivard & Huff, 1988). Research indicated that negative attitudes towards computer technology hindered end users' acceptance and future use of computer technology (e.g., Davis, 1989; Nelson & Cheney, 1987; Rivard & Huff, 1988). Moreover, there was evidence that individuals' perceptions/attitudes were predictive of existing and future behaviours (Dweck, 1986), for example, using acquired computer skills and learning new computer skills.

Ajzen defined an attitude as "a predisposition to respond favourably or unfavourably to an object, person, institution, event or another discriminable aspect of the individual's world" (cited in Melone, 1990, p. 77). End users developed attitudes by learning and watching other individuals' behaviours (Melone, 1990). Theory indicated that one important element of learning and training was a positive

attitude (Gattiker & Hlavka, 1992) and end users' attitudes regarding the perceived ease of use and usefulness of computer technology were important factors (Zmud, 1979).

Acceptance. Investigators suggested that a prevalent problem encountered by organizations was the resistance displayed by employees and managers to computer technology (Davis, et al., 1989). Several adverse consequences were associated with end users' resistance to computer technology: 1) individuals' performance was impeded; 2) organizational performance was hindered (Davis, et al., 1989); and, 3) organizational investment in computer technology was risky (Davis, et al., 1989). One possible explanation why employees and managers resisted computer technology may be the lack of effective and efficient end-user training. For example, Nelson and Cheney (1987) reported that managers' dominant computer training method was self-training and that the majority of managers (80%) believed that the amount of training they had received, regardless of the type of training (e.g., self-training, college training, company training, and vendor training) was nonexistent, negligible, or moderate.

The successful adoption of computer technology required that the end user develop an adequate knowledge base (Bagozzi, et al., 1992). Research indicated that increased training may result in an increase in the probability that an end user will accept and use a computer system (Nelson, 1991). Therefore,

a positive, effective and efficient training program may also increase end users' acceptance of computer technology.

Motivational Intent. To date, only limited research has explored the intricacies of end users' motivational processes and effective learning (Noe & Schmitt, 1986); instead, most research has concentrated on how various factors influence learning performance (Bostrom et al., 1990; Gattiker, 1987; Gattiker & Paulson, 1987; Snow, 1986; Wexley, 1984). Two factors which effected end users' use of computer technology: 1) the extent end users attempted to learn how to use a computer and 2) end users' intention or motivation to use computer technology (Bagozzi et al., 1992). One of the distinctive characteristics of effective learning was the motivation or tendency to apply what individuals learned in a given environment to novel tasks and situations in the future (Dweck, 1986). Dweck (1986) suggested that motivational factors might influence the effective utilization of an individual's current skills and knowledge, an individual's effective accumulation of new skills and knowledge, and an individual's effective transfer of new knowledge and skills to novel situations (e.g., computer skills). Therefore, motivational intent to use computer technology appeared to be a direct antecedent of continued computer usage.

Davis et al. (1989) concluded that end users' perceived ease of use and usefulness of computer systems were determinants of their intentions to use computers and these

intentions were important predictors of end users' actual use of computer technology. End users appeared to develop quickly, after one-hour of hands-on experience with computer technology, a general perception of computer usefulness and future acceptance of computer technology (Davis et al., 1989). This indicated that training programs must be effective from their onset. Davis et al. (1989) reported that over time, an end user's self-efficacy perspective of the likelihood of successfully learning to use computer technology developed into a perception regarding how the end user's effort to utilize this technology will impact her/his performance. Davis (1993) indicated that end users' usage of computer technology was significantly effected by their attitude towards using computer technology.

Davis and Bostrom (1993) indicated that the majority of research has investigated the outcomes of end-user training (e.g., learning performance and attitudes) immediately after training. Research that investigated the long-term effects of end-user training was nonexistent (Davis & Bostrom, 1993). Davis and Bostrom (1993) stressed the need for research that investigated the change to end users' attitudes over time. Therefore, investigating the incremental change over time to end users' motivational intent to use computer technology may provide important and new information regarding the effectiveness of training programs and end users' usage and acceptance of computers.

Individual Differences

In recent years, literature related to educational psychology and management indicated that individual differences were a source of variance for training outcomes (e.g., Gattiker & Hlavka, 1992; Snow, 1986). Bostrom et al. (1990) emphasised that effective training for the end user would result if training methods were matched to individual differences. Spohrer and Soloway (1986) stressed that the more teachers knew about their students, how they learn and what factors were important in the learning process, the better teachers they became.

To date, limited research has explored how individual differences may effect end users' motivational intent to use computer technology. Instead, research has explored the effects of individual differences on learning performance. Research suggested that individual differences (e.g., learning styles, anxiety, previous experience) played a role in end users' learning curves of computer software (Bostrom et al., 1990; Wexley, 1986). Snow (1986) reported that individual differences appeared to be related directly to individuals' learning performance. Based on the results of individual differences and learning performance, an inference about the effect of individual differences and motivational intent to use computer technology can be drawn.

Training Model

Recently, MIS studies responded to the shortage of empirical research by advancing several theoretical models which link end user training to conceptual paradigms (e.g., Bostrom et al., 1990; Davis & Bostrom, 1993; Nelson & Cheney, 1987). These paradigms integrated theory and research material from cognitive psychology, educational psychology, management, and MIS. Research suggested that effective computer training resulted in two training outcomes: improved learning performance and positive perceptions about computer technology (Bostrom et al., 1990; Davis & Bostrom, 1993; Sein et al., 1987). The training outcomes were a multiplicative consequence of the end user's motivation and ability (Wexley, 1984). Additional research indicated that the training outcomes for end users were influenced by three diverse components: 1) characteristics of the trainee (individual differences); 2) characteristics of computer technology (target system); and 3) end-user training methods (training method) (Bostrom et al., 1990; Davis & Bostrom, 1993; Sein et al., 1987).

Outlined in Figure 1 is a modified subset of the end-user training model developed by Bostrom et al. (1990) (see Appendix B). The training model developed by Bostrom et al. (1990) was of particular interest because it hypothesized that individual differences were important factors that may influence training outcomes. This study utilized Bostrom,

Olfman and Sein's training model to investigate the potential effects, interactions and relationships between individual differences and end users' motivational intent to use computer technology. The individual differences included in this study were a subset of the comprehensive list of individual differences identified by Bostrom et al. (1990). This group of individual differences was selected because prior studies have focused only on one or two of these individual differences, especially certain descriptive traits (e.g., previous computer experience).

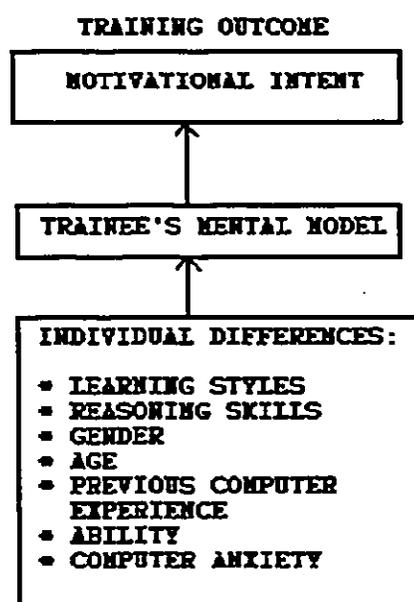


Figure 1. A Modified Subset of Bostrom, Olfman, & Sein's (1990) Research Model for End-User Training

An extensive literature review revealed that empirical studies which examined the effects and relationships between

a comprehensive group of individual differences and motivational intent to use computer technology, and empirical studies that specifically applied Bostrom, Olfman and Sein's training model to this relationship appeared not to exist. However, the literature recommended that an empirical study investigating the interaction and effects of individual differences and training outcomes be undertaken (e.g., Bostrom et al., 1990).

Cognitive Traits

Learning Styles. Over the past two decades psychology, education, and management research was interested in and investigated learning styles (Bostrom et al., 1990; Davidson, 1990; Davidson et al., 1992; Partridge, 1993). This research into learning styles has resulted in the development of over 21 different learning style models (Moran, 1991). A universal learning style theory or measurement was not presented in the research literature (Bostrom et al., 1990) nor was a collective definition (Moran, 1991). However, Davidson's (1990) definition for learning styles appeared to encapsulate the common theme that learning styles were distinctive techniques used by individuals to gather and process information.

Research identified a number of personal characteristics that directly influenced learning styles. Living environment, personal experiences, and heredity were factors that determined an individual's learning style (Gregorc, 1979;

Partridge, 1993). Davidson et al. (1992) stated that learning styles were "a result of nature and nurture" (p. 349). An individual's dominant learning style was his/her preferred manner of learning.

The following characteristics were associated with learning styles: 1) learning styles were relatively stable over time; 2) learning styles were constant patterns of behaviours; and, 3) learning styles were value-free (Davidson et al., 1992). Learning styles were considered value-free because individuals' learning styles were different and not preferred to other styles (Davidson et al., 1992). Research supported the theory that learning styles were relatively stable over time. For example, Pinto and Geiger (1991) reported that college students' learning styles did not change significantly over a one-year period of time.

Wexley (1984) suggested that designers of training programs use the knowledge about cognitive styles to develop individualized training methods. Abouserie, Moss and Barasi (1992) reported that students' cognitive style effected their perception of computer-assisted learning (CAL); for example, students who were field dependent (e.g., preferred structured presentation that provided specific information) displayed a more positive attitude and were more amenable to relying entirely on CAL than field independent students. Vernon-Gerstenfeld (1989) indicated that an end user's learning style, based on Kolb's Learning Style Inventory instrument,

was not an important predictor of computer technology adoption. Overbaugh (1993) found no relationship between computer anxiety and learning styles.

A literature review indicated that, to date, empirical research which investigated whether end users' learning styles effect their motivational intent to use computer technology appeared not to exist. In this context, end users with concrete learning styles may prefer performing certain computer tasks (e.g., step-by-step programming), which may result in a higher motivational intent to use computer technology. This raises the following questions:

Question 1: Are end users with concrete learning styles more motivated (pretest and posttest) to use computer technology than end users with abstract learning styles?

Question 2: Are learning styles an important predictor of the incremental change over time to end users' motivational intent to use computer technology?

Structure Strategies

Reasoning Skills. A literature review indicated that research about individuals' reasoning schemata and their motivational intent to use computer technology appeared not to exist. Instead, instructional psychology was interested in and explored how analogical reasoning strategies effected performance of complex tasks (Pintrich, Cross, Kozma, & McKeachie, 1986) and learning performance (Hagborg & Wachman, 1992; Pommersheim & Bell, 1986; Strahan & O'Sullivan, 1990).

Strahan and O'Sullivan (1990) reported that the cognitive reasoning level of middle school students was a significant predictor of achievement and explained a significant portion of the variance in achievement test performance. Strahan and O'Sullivan (1990) recommended that students' level of reasoning be considered when designing instruction plans. Pommersheim and Bell (1986) reported that research by Schroeder indicated that, compared to spatial reasoning abilities, formal-operational Piagetian reasoning ability and mathematical reasoning ability were better predictors of the learning performance of university students enrolled in a computer programming course. Conversely, Hagborg and Wachman (1992) reported that students' cognitive reasoning schemata were not effective for predicting academic achievement.

In this context, the point of interest, inferred from research investigating reasoning strategies and complex task performance or learning performance, is to examine the potential effects and relationships between end users' cognitive reasoning schemata and perceived motivational intent to use computer technology. This, leads to the following questions:

Question 3: Are end users with formal reasoning levels more motivated (pretest and posttest) to use computer technology than end users with concrete or transitional reasoning levels?

Question 4: Are formal reasoning levels important predictors of the incremental change over time to end users' motivational intent to use computer technology?

Descriptive Traits

Zmud's (1979) literature review indicated that individual differences were major factors which effected the successful adoption of computer technology. Research provided evidence that certain end users, (e.g., women, older individuals, and individuals who were less educated) exhibited less positive attitudes towards computer technology (Zmud, 1979).

Gender. The results of empirical studies which investigated the relationship between gender and end users' attitudes regarding computer technology indicated that a consistent pattern existed--men tended to be more positive about computer technology. Research indicated that a gender stereotype existed for computer technology; specifically, computer technology and activities were positioned in the male domain (Harrison & Rainer, 1993). Abouserie et al. (1992) reported that gender was a significant factor in assessing medical students' attitudes regarding the use of computer assisted learning (CAL); specifically, male medical students statistically preferred using CAL more than female medical students. Gattiker and Hlavka (1992) reported the presence of significant gender differences between men's and women's attitudes towards computer technology; however, posteriori contrasts revealed that men and women do not significantly differ in their attitudes towards computer technology once they have purchased a computer. Pommersheim and Bell (1986) reported that after completing a BASIC programming course more

male students than female students continued to use and learn more about the BASIC programming language. Harrison and Rainer (1993) reported that women were more apprehensive about using computer technology and that their apprehension about computers may hinder future usage.

Other research contradicted the empirical results that gender appeared to influence end users' attitudes regarding computer technology. For example, Parasuraman and Igarria (1990) reported an absence of gender differences between male and female managers' attitudes towards computer technology.

Age. Gist et al. (1988) reported that little empirical research existed which identified the relationship between age and end-user training outcomes; although, age stereotypes existed in abundance. The popular, stereotypical, non-substantiated belief was that older employees were less capable, lacked the motivation to benefit from training, were more rigid and resistant, and less receptive to change (Gist et al., 1988). Igarria and Parasuraman (1989) reported that older managers' attitudes towards computer technology were more unfavourable and were significantly different from younger managers. Steiner et al. (1991) indicated that special training programs for older employees may need to be developed and Igarria and Parsuraman (1989) indicated that the development of more effective training programs for older end users may decrease their negative attitude towards computer technology.

However, Czaja, Hammond, Blascovich, and Swede (1989) reported that older employees' attitudes towards computer technology were similar to younger employees' attitudes towards computer technology. Bostrom et al. (1990) stressed the need for additional research investigating the relationship between age and end users' motivational intent to use computer technology.

Previous Computer Experience. Research indicated that prior computer experience and knowledge influenced end users' perceptions of computer technology. Rivard and Huff (1988) reported that prior computer experience was significantly related to end users' perception of software user-friendliness and end users' perceptions/attitudes regarding user development of computer application programs. End users' perceptions of the software friendliness and perceptions/attitudes regarding software development were also significantly related to end users' overall satisfaction with computer interfaces (Rivard & Huff, 1988). Research indicated that trainers and instructors of computer courses need to be aware of, and may find it helpful to know about, the effects of prior computer experience on end users' perceptions (Rivard & Huff, 1988). Research recommended that end users' general computer literacy be improved before they receive training for specific software applications (Rivard & Huff, 1988). However, Kahn and Robertson (1992) reported that previous

computer experience was not an important determinant of end-users' motivation to use computer technology.

Previous computer experience was defined in two different contexts in this thesis. The first context of previous computer experience was the successful completion of one or more basic computer courses. The second context of previous computer experience was hands-on experience with computer technology in the classroom, workplace, and/or home.

Scholastic Ability. Research has investigated the relationship between end users' scholastic abilities (a priori grade point average and micro grade point average) and their learning performance (e.g., Davis & Bostrom, 1993; Gattiker, 1987; Gattiker & Paulson, 1987), but limited empirical research has investigated the relationship between end users' scholastic abilities and their attitudes regarding computer technology. Research provided evidence that the computer attitudes of students withdrawing from an introductory computer course were significantly different from students receiving a letter grade, regardless of the grade awarded (Gattiker & Hlavka, 1992). However, students' attitudes regarding computer technology were not statistically different between letter grade groups, except for the complexity scale (e.g., difficult, complicated, required technical ability, required mathematical skills) comparing "C" grades with "A" grades and "B" grades with "A" grades, and for the productivity scale (e.g., made company more productive, made

person more productive at his/her job) comparing "B" grades with "A" grades (Gattiker & Hlavka, 1992). Investigating the relationship between end users' scholastic abilities and their perceived motivation to utilize computers might provide important information for designing effective and efficient computer training programs.

Zmud's (1979) literature review indicated that the relative importance of individual differences and their specific relationship with successful end-user computing still remains unknown. Therefore, the following question is important:

Question 5: Are individual differences--age, gender, previous computer experience and scholastic ability--important predictors of the incremental change over time to end users' motivational intent to use computer technology?

Attitude States

Computer Anxiety. Management, psychology, and MIS research established the importance of computer anxiety (e.g., Igbaria & Parasuraman, 1989; Snow, 1986; Zmud, 1979). Research suggested that the following variables were important predictors of anxiety: experience, formal course work, gender, education, external locus of control, and math anxiety (Gilroy & Desai, 1986; Igbaria & Parasuraman, 1989). Igbaria and Parasuraman (1989) reported a statistically significant, negative relationship between managers' anxiety and their attitude towards computer technology. In a later study, Parasuraman and Igbaria (1990) reported that computer anxiety

was an important determinant of end users' attitude towards technology for both men and women. In this context, based on an inference from end users' attitudes and learning performance, one would also expect that end users' level of anxiety might effect their perceived motivational intent to use computer technology.

A literature review indicated that certain end users may experience computer anxiety (Gilroy & Desai, 1986; Zmud, 1979). Gilroy and Desai (1986) reported that women experience more anxiety than men because women lacked computer experience. This phenomenon may decrease as more and more organizations automate office environments and more and more women enrol in computer science and management programs. Research also indicated that end user interaction with computer systems reduced an end user's level of computer anxiety (Gilroy & Desai, 1986; Overbaugh, 1993). For example, Overbaugh (1993) indicated that six hours of instructional time significantly reduced computer anxiety.

Gilroy and Desai (1986) concluded that an application-oriented training method reduced end users' level of anxiety more than a computer programming method. Gilroy and Desai (1986) recommended that educators and trainers divide students/trainees into two separate groups and use a function training approach (e.g., word-processing application) to desensitize end users with high levels of anxiety before other computer applications or programming were introduced.

Davis et al. (1989) recommended that future research investigate the relationship between perceived ease of use, usefulness, and acceptance of computer technology with other variables (e.g., anxiety) to advance our knowledge about end users' perceptions. The following questions may provide important information:

Question 6: Are end users with low levels of anxiety more motivated (pretest and posttest) to use computer technology than end users with high levels of anxiety?

Question 7: Are end users' levels of anxiety important predictors of the incremental change over time to their motivational intent to use computer technology?

Chapter 3: Methodology

The purpose of this chapter was to outline the research design and methodology. The first section discussed the research design and participants. Next, the research instruments, specifically, a learning style construct, a cognitive reasoning construct and the questionnaire were described. The empirical model and the statistical techniques utilized were outlined in the final section.

Design and Subjects

The research design of this study was a descriptive research approach that utilized a survey instrument (based on repeated measures over time) and two different types of constructs. Access was gained to students enrolled in an undergraduate computer application course with the Faculty of Management (see Appendix C for a description of the computer application course). Students' participation in the study was voluntary and confidential. The data set was gathered over eleven semesters. A portion of the complete data set was of interest and was used for this thesis. The sub-set of data included students enrolled during five semesters. Of the 182 students enrolled in the computer application course during the five semesters, 143 students agreed to participate (78.57%) in the sub-sample.

Different instructors were responsible for the undergraduate software application course. The in-class lecture component was taught by one instructor and the

computer lab component was taught by the other instructor during four of the five semesters. During the five semesters, instructors and their teaching styles may have changed in the classroom and each instructor's teaching style differed between the classroom and laboratory settings. However, the instructional style in the labs followed the same format for all five semesters: after the instructor outlined application commands in the computer lab, the students practiced these commands on their assigned computers. The course syllabus, course content, instructional manual for the lab, textbook (for four semesters), and evaluation criteria for the labs were similar.

Students were asked to complete a questionnaire twice during the semester: 1) during the first week of the semester (pretest) and 2) during the last week of the semester (posttest) (a time lapse of approximately 10 weeks). At the beginning of each semester, students were asked to complete the Gregorc Style Delineator³ (see Appendix D). Following the administration of the Gregorc Style Delineator, a feedback session was held to brief students on the learning style construct and the usefulness of different learning styles and to inform each student of his or her learning style. Students were also asked to complete the Arlin Test of Formal

³ The Gregorc Style Delineator has not been included in the thesis because of the unavailability of copyright permission. Gregorc (1984) was the original source of the Gregorc Style Delineator.

Reasoning⁴ (ATFR) (see Appendix E) at the beginning of the semester. Following the administration of the ATFR, a student feedback session was held to brief students on the test and test scores. The questionnaire, the Gregorc Style Delineator, and the ATFR were administered during three different class periods.

Instruments

Gregorc Style Delineator. Participating students completed the Gregorc Style Delineator: a paper-and-pencil, self-assessment instrument for identifying the learning styles of individuals. The Gregorc Style Delineator consisted of 10 sets of four descriptive words. To rank the four descriptive words in each set, students were required to use a four-point scale, ranging from (4) "most descriptive of you" to (1) "least descriptive of you."

The total score for the ranking of the 40 descriptive words indicated an end user's placement in four different types of learning styles: Abstract Random (AR), Abstract Sequential (AS), Concrete Random (CR), and Concrete Sequential (CS). A participant's dominant learning style was determined by a score greater than or equal to 27 for any of the four categories of learning styles. Gregorc (1984) reported the following standardized alpha values for internal consistency

⁴ The Arlin Test of Formal Reasoning has not been included in this thesis because of the unavailability of copyright permission. Arlin (1984) was the original source of the Arlin Test of Formal Reasoning.

as an indication of the reliability of the instrument: $\alpha = .87$ for AR scale; $\alpha = .87$ for the AS scale; $\alpha = .87$ for the CR scale; and $\alpha = .85$ for the CS scale. See Appendix D for a discussion regarding the psychometric quality of the Gregorc Style Delineator.

Arlin Test of Formal Reasoning. Students also completed the ATFR, which assessed each individual's overall level of cognitive reasoning. The ATFR was a paper-and-pencil test and consisted of 32 multiple-choice questions, each with four possible answers. The format of the ATFR consisted of thirteen graphical representations of problems. After each graphical drawing, the student was required to answer several multiple-choice questions which were related to the drawing.

An end user's total score for the 32 multiple choice questions indicated his or her cognitive reasoning level at that point in time. Arlin (1984) based an individual's cognitive reasoning level on the following breakdown: Concrete (LC) = total score ranging from 00 to 07; High Concrete (HC) = total score ranging from 08 to 14; Transitional (TRANS) = total score ranging from 15 to 17; Low Formal (LF) = total score ranging from 18 to 24; and, High Formal (HF) = total score ranging from 25 to 32.

Arlin (1984) reported that the ATFR was a reliable and valid instrument with reliability based on internal-consistency alphas ranging from .60 to .73. The validity of the ATFR was based on a multitrait-multimethod procedure with

the subtest coefficients ranging from .55 to .74. See Appendix E for a discussion regarding the psychometric quality of the ATFR.

Computer Questionnaire. Participants completed a 204-item questionnaire (see Appendix F) which assessed their attitudes about computer related issues, their expected class performance, and which also compiled social background information. The questions developed for the survey were based on an extensive literature review of computer studies.

The computer survey consisted of several sections. The first section queried students about their attitudes towards computers. The second section queried students about the amount of time each student expected to spend working on this class content. The third section queried students of their attitudes regarding the way in which they thought computer skills might facilitate their work progress and career. The fourth section queried students about their intended use of computers outside of the class. The fifth section queried students about their general knowledge regarding computers. The final section queried students about their expected performance level for the class. All survey questions, except those directed at each student's expected performance level for the class, utilized a five-point Likert-type scale, ranging from (1) "disagree completely" to (5) "agree completely".

Only data from certain sections of the computer questionnaire were used in this thesis. The data of interest were generated by the following sections of the survey: section one, students' attitudes towards computers; section four, students' intended use of computers; section five, students' general knowledge regarding computers; and, socio-demographic background.

Factor analyses employing orthogonal varimax rotations were done to obtain the dependent factor and the independent factors (see Tables 1, 2, and 3 for a list of the Questionnaire items). Eigenvalues greater than 1.0 were used to determine the number of factors for orthogonal varimax rotation and interpretation (Kaiser, 1982). Comrey (1973) categorized factor loadings in the following manner: 1) loadings greater than .71 were considered excellent; 2) loadings between .71 and .63 were considered very good; 3) loadings between .62 and .55 were considered good; 4) loadings between .54 and .45 were considered fair; and 5) loadings between .44 and .32 were considered poor. The Burt-Banks criterion indicated that factor loadings greater than .30 were statistically significant at a probability level less than .001 (Child, 1970). However, this study employed a more conservative approach and only items loading greater than .50 were considered for the dependent factor labelled **MOTIVATIONAL INTENT** and the independent factors labelled **ANXIETY** and **GENERAL COMPUTER LITERACY** (see Tables 1, 2, and 3).

Next, reliability analysis was conducted for each factor. During the early stages of statistical formulation, reliability coefficients greater than .70 were suggested as the desirable minimum for the development of constructs (Nunnally, 1978, pp. 246). This level was attained for the dependent variable, **MOTIVATIONAL INTENT**, and for the independent variables, **ANXIETY** and for the pretest **GENERAL COMPUTER LITERACY** (see Tables 4, 5, and 6).

Empirical Model and Analyses

Studies have investigated the relationships between end users' attitudes towards computer technology (e.g., acceptance of computer technology, adoption of computer technology, ease of use) and age (cf. Gist, et al., 1989; Czaja, et al., 1989), gender (cf. Gattiker & Hlvaka, 1992; Parasuraman & Igarria, 1990), and previous computer knowledge (cf. Kahn & Robertson, 1992; Rivard & Huff, 1988). The results of these studies were mixed and inconclusive. Various investigators have theorized that individual differences (e.g., learning styles, cognitive reasoning levels, scholastic ability, age, gender, previous computer experience, and anxiety) may effect end users' training outcomes, learning performance and motivational attitude (Bostrom, et al., 1990; Davis, et al., 1989; Mathieu, Martineau, & Tannenbaum, 1993; Olfman, Sein, & Bostrom, 1986; Zmud, 1979). To date, however, the incremental change over time to end users' **MOTIVATIONAL INTENT** to use computer technology has not been addressed by the research community.

First, it was necessary to determine if end users' **MOTIVATIONAL INTENT** to use computer technology at the beginning of the computer course (pretest) was significantly different from their **MOTIVATIONAL INTENT** to use computer technology at the end of the computer course (posttest). Next, profile analyses⁵, based on a between-within design, were performed on the dependent variables, pretest and posttest **MOTIVATIONAL INTENT**, and the independent variables, pretest and posttest **ANXIETY** to determine if the variances for the between-groups, within-subjects and interactions were significant. To ascertain the source of variability, a series of ANOVAs was performed to determine if the between-group means (categorized by learning styles, cognitive reasoning levels, gender, and level of anxiety)⁶ of the pretest

⁵ Profile analysis was applicable for research designs where the participants were measured repeatedly on the same dependent variable (Tabachnick & Fidell, 1989, chap. 10). Profile analysis was a multivariate approach that applied a MANOVA technique based on a between-within design. The same range of possible scores must be used for all measures (Tabachnick & Fidell, 1989, p. 438). Profile analysis tested three effects: levels of profiles (between-group effect), flatness of profiles (within-subjects effect), and parallelism of profiles (interaction) (Tabachnick & Fidell, 1989, p. 438). The profile analysis design for this study included only one independent variable, therefore, unequal cell sizes were not an issue (Tabachnick & Fidell, 1989, p. 440).

⁶ Random assignment to cells was not a concern for the following reasons: 1) all students in the Faculty of Management were equally likely to be included in the study; and 2) social and behavioral science use the general practice of treating samples as random samples (Christensen & Stoup, 1991). The practice of treating samples as random samples was not a concern because the inferential statistical techniques were robust and not affected by random violation and the bias was small (Christensen & Stoup, 1991, p. 207-208).

MOTIVATIONAL INTENT and of the posttest **MOTIVATIONAL INTENT** were different. A sequence of ANOVAs also analyzed the between-group means of the independent variables, pretest and posttest *ANXIETY*. Finally, it was necessary to determine if *learning styles, cognitive reasoning styles, age, gender, scholastic ability, previous computer knowledge, and anxiety* (see Table 7 for definitions of the variables) were important predictors of the incremental change to end users' **MOTIVATIONAL INTENT** to use computer technology. The multiple regression model outlined in Table 8 was estimated and explored (see Table 7 for definitions of the variables).

Chapter 4: Results

Table 7 outlined the definitions of the dependent variables and the independent variables. The descriptive statistics for the dependent variable, **MOTIVATIONAL INTENT**, and the independent variables were outlined in Tables 9 and 10. A t -test was performed to compare the pretest mean of the dependent variable with the posttest mean of the dependent variable. The result of the t -test indicated that the pretest and posttest means of **MOTIVATIONAL INTENT** were statistically different ($t = 3.01$, one-tail $p < .01$) (see Table 11). By the end of the semester, students' **MOTIVATIONAL INTENT** to use computer technology for university assignments, personal tasks, personal budgets, and private correspondences had increased.

To facilitate the organization and to improve the flow of the result section, the research questions were answered in order of the statistical technique utilized rather than in ascending order.

Between-Groups Differences

Research Question 1. Question 1 asked whether end users with concrete learning styles were more motivated to use computer technology than end users with abstract learning styles. Profile analysis based on a **MOTIVATIONAL INTENT X LEARNING STYLE** (2 X 5) factorial model utilizing SPSS' MANOVA was performed to analyze the within cell variance of **MOTIVATIONAL INTENT** for the pretest and posttest means and the

between-group variance. The profile analysis indicated that the F values for the within cell variance of the pretest and posttest means of **MOTIVATIONAL INTENT**, the between-group variance, and the **MOTIVATIONAL INTENT BY LEARNING STYLE** interaction were not statistically significant (see Table 12).

Two univariate analysis of variance (ANOVAs) based on a **MOTIVATIONAL INTENT X LEARNING STYLE (1 X 5)** design were performed to compare the pretest means of **MOTIVATIONAL INTENT** for the five groups of learning styles (CS, CR, AR, AS, and *more than one dominant learning style*) and to compare the posttest means of **MOTIVATIONAL INTENT** for the five groups of learning styles. The univariate F values from SPSS' ANOVAs indicated that the pretest and posttest means among the five groups of learning styles for the dependent variable were not statistically different (see Table 13). At the beginning of the semester, end users categorized as having *more than one dominant learning style* held a more positive attitude about their motivational intent to use computer technology than end users categorized as CS, CR, AR, and AS (see Table 10). By the end of the semester, CR end users were the most motivated to use computer technology. An interesting point was that after 10 weeks end users' motivational intent to use computer technology decreased for end users' categorized as having *more than one dominant learning style*; whereas, end users' motivational intent to use computer technology increased for CS, CR, AS, and AR learning style groups.

These findings suggested the answer to research question 1 was no; end users' evaluations about their motivational intent to use computer technology do not differ between the learning style groups.

Research Question 3. This question attempted to determine whether end users with formal reasoning levels were more motivated to use computer technology than end users with concrete or transitional reasoning levels. A profile analysis based on a MOTIVATIONAL INTENT X COGNITIVE REASONING (2 X 5) factorial model utilizing SPSS' MANOVA was performed to analyze the within cell variance of the pretest and posttest means of MOTIVATIONAL INTENT and the between-group variance of MOTIVATIONAL INTENT. The profile analysis indicated that the F values for the between-group variance and the MOTIVATIONAL INTENT BY REASONING LEVEL interaction were not statistically significant; however, the within cell variance of the pretest and posttest means of MOTIVATIONAL INTENT was statistically significant ($F = 8.74, p < .01$) (see Table 12).

SPSS' ANOVAs employing a MOTIVATIONAL INTENT X COGNITIVE REASONING (1 X 5) design were used to compare the pretest means of MOTIVATIONAL INTENT for each of the five cognitive reasoning groups (LC, HC, TRANS, LF, and HF) and the posttest means of MOTIVATIONAL INTENT for each of the five cognitive reasoning groups. The F values from the ANOVA analyses indicated that the between-group pretest and posttest means of the dependent variable were not statistically different (see

Table 13). At the beginning of the semester, *TRANS* end users were the most motivated to use computer technology (see Table 10). However, by the end of the semester, *LF* and *HF* end users were more motivated to use computer technology. After 10 weeks, end users' motivational intent to use computer technology had increased for all five cognitive reasoning groups.

These findings suggested that the answer to research question 3 was no; *end users' evaluations about their motivational intent to use computer technology do not differ between the cognitive reasoning schemata*. However, the within cell variance of the pretest and posttest means of **MOTIVATIONAL INTENT** was statistically significant. End users who were grouped by their cognitive reasoning schemata demonstrated a significant change to their **MOTIVATIONAL INTENT** during the 10 weeks of training.

Post-hoc Analysis of MOTIVATIONAL INTENT. The post-hoc analysis was performed to make recommendations for future research. Post-hoc analysis highlighted some interesting results regarding the relationship between gender groups and end users' **MOTIVATIONAL INTENT** to use computer technology. Subsequent profile analysis based on a **MOTIVATIONAL INTENT X GENDER** (2 X 2) factorial model and ANOVAs based on a 1 X 2 design were performed to determine if a gender difference for the dependent variable existed. The profile analysis indicated that the between-group variance and the within cell

variance of the pretest and posttest means for the dependent variable, **MOTIVATIONAL INTENT**, were statistically significant ($F = 5.05, p < .05$; $F = 10.77, p < .001$, respectively) (see Table 12). However, the **MOTIVATIONAL INTENT BY GENDER** interaction was not statistically significant (see Table 12). The results of the ANOVAs indicated that, at the beginning of the semester, male students were statistically more motivated to use computer technology ($F = 7.047, p < .01$) (see Table 13). Male students believed that they would use a microcomputer for personal budgets, for personal task, for private correspondences, and for university assignments. However, by the end of the semester, the between-group mean of **MOTIVATIONAL INTENT** was not statistically different between males and females (see Table 13).

Research Question 6. This question asked whether end users with low levels of anxiety were more motivated to use computer technology than individuals with high levels of anxiety. Profile analysis based on a **MOTIVATIONAL INTENT X ANXIETY LEVEL (2 X 3)** factorial model utilizing SPSS' MANOVA was performed to analyze the within cell variance of the pretest and posttest means of **MOTIVATIONAL INTENT** and the between-group variance. The profile analysis indicated that the F values for the between-group variance and the **MOTIVATIONAL INTENT BY LEVEL OF ANXIETY** interaction were not statistically significant; however, the within cell variance

of the pretest and posttest means of **MOTIVATIONAL INTENT** was statistically significant ($F = 9.40, p < .01$) (see Table 12).

Two ANOVAs based on a **MOTIVATIONAL INTENT X ANXIETY LEVEL** (1 X 3) design were performed to compare the pretest means of **MOTIVATIONAL INTENT** for the three levels of **ANXIETY** (negative, neutral, and positive) and the posttest means of **MOTIVATIONAL INTENT** for the three levels of **ANXIETY**. The F value from SPSS' ANOVA indicated that the between-group mean of the pretest independent variable was statistically different ($F = 3.043, p = .05$) (see Table 13). At the beginning of the semester, anxious end users were the least motivated to utilize computer technology (see Table 10). However, by the end of the semester, end users' **MOTIVATIONAL INTENT** to use computer technology was not statistically different between the three groups of **ANXIETY** (see Table 13). At the beginning of the semester and also at the end of the semester, end users who perceived their level of **ANXIETY** to be *neutral* were the most motivated to use computer technology for university assignments, personal tasks, personal budgets, and private correspondences. By the end of the semester, the **MOTIVATIONAL INTENT** to use computer technology for all end users, regardless of their level of anxiety, increased (see Table 10).

These findings suggested that research question 6 be answered with a yes--end users' evaluations about their *motivational intent to use computer technology do differ*

between levels of anxiety. At the beginning of the semester, the between group means of MOTIVATIONAL INTENT was statistically significant. In addition, the within cell variance of the pretest and posttest means of MOTIVATIONAL INTENT was also statistically significant. End users who were grouped by their anxiety level demonstrated a significant change to their MOTIVATIONAL INTENT during the 10 weeks of training.

Post-hoc Analyses of Anxiety. The post-hoc analyses was generated to outline implications for future research. Post-hoc analyses highlighted some interesting results regarding end users' perceived level of ANXIETY. The result of the t -test indicated that the pretest and posttest means of ANXIETY were statistically different ($t = -1.86$, one-tail $p < .05$) (see Table 11).

Subsequent profile analyses and ANOVAs were performed to determine if end users perceived level of ANXIETY differed among various groups of end users (e.g., learning style, cognitive reasoning level, and gender). The results of the statistical analysis indicated that end users' perceived level of ANXIETY was not statistically different among the learning style groups.

The results of the profile analyses and ANOVAs highlighted several statistically significant main effects between end users' perceived level of ANXIETY and cognitive reasoning schemata and gender. For example, the profile

analysis indicated that the cognitive reasoning between-group variance was statistically significant ($F = 3.16, p < .05$); however, the within subjects variance of the pretest and posttest dependent variables and the *ANXIETY BY COGNITIVE REASONING LEVEL* interaction were not statistically significant (see Table 12). The within cell variance of the pretest and posttest means of *ANXIETY* for the gender group was statistically significant ($F = 3.87, p < .05$) (see Table 12).

The results of subsequent ANOVAs indicated that both the pretest means and the posttest means of *ANXIETY* for the five cognitive reasoning groups were statistically significant ($F = 2.1818, p < .05$; $F = 3.01, p < .05$, respectively) (see Table 13). At the beginning and at the end of the semester, individuals with a concrete reasoning level believed that working with computers was difficult, stressful and complicated (see Table 10). By the end of the semester, *TRANS* and *LF* end users' perceived level of *ANXIETY* had decreased and *HC* and *HF* end users' perceived level of *ANXIETY* had increased (see Table 10).

Multiple Regression

Model Building. Originally, model building approaches employing SPSS' multiple regression techniques were performed to determine if independent variables other than the factors outlined in the literature review were important predictors of the incremental change over time to end users' **MOTIVATIONAL INTENT**. The incremental change over time to end users'

MOTIVATIONAL INTENT was calculated by subtracting the pretest score of MOTIVATIONAL INTENT from the posttest scores of MOTIVATIONAL INTENT. The supplementary independent variables examined included: 1) various factors for end users' previous computer experience, for example, computer literacy, keyboarding skills, and mainframe experience; and, 2) various factors for the classroom instructor, type of university program, current year of program, and number of months since a student had completed her or his last university course. The results of these model building approaches indicated that none of these supplementary independent variables were statistically significant predictors of the dependent variable, incremental change to MOTIVATIONAL INTENT.

Final Regression Model. SPSS' multiple regression analysis entering all the independent variables outlined in the regression equation (see Table 8) and stepwise regression were used to answer research questions 2, 4, 5, and 7. The correlation matrix of the dependent factor and independent variables indicated that multicollinearity was not present (see Table 14). Results of the multiple regression analyses were considered significant if p values were less than or equal to 0.10 (see Cohen, 1990 for a discussion regarding the levels of p values). The regression equation outlined in Table 8 was not statistically different from zero and only explained 1% of the variance in the incremental change to end

users' **MOTIVATIONAL INTENT** (posttest scores minus pretest scores) to use computer technology (see Table 15).

Research Question 2. This question attempted to determine if learning styles were important predictors of the incremental change to end users' **MOTIVATIONAL INTENT** (posttest scores minus pretest scores) to use computer technology. To test the impact of learning styles (*AS, AR, CR, CS, and more than one dominant learning style*) on the dependent variable, four dummy variables with *CR* established as the base were constructed (see Table 7 for explanation). The multiple regression analysis indicated that the base variable for learning styles, *CR*, in the full model was significantly different from zero because the *F*-statistics for two of the dummy variables, *CS* and *more than one dominant learning style*, were statistically significant ($F = 3.243, p < .10$; $F = 3.681, p < .10$, respectively) (see Table 15). Therefore, the answer for research question 2 was yes--*the additive effects of the dummy variables indicated that the base variable for learning styles, CR, compared to CS and "more than one dominant learning style", in the full model was a better predictor of and increased the explanation of the variation in the incremental change to end users' MOTIVATIONAL INTENT to use computer technology.*

Research Question 4. This question asked if cognitive reasoning levels were important predictors of the incremental change to end users' **MOTIVATIONAL INTENT** (posttest scores

minus pretest scores) to use computer technology. To test the impact of end users' reasoning schemata (*LC*, *HC*, *TRANS*, *LF*, and *HF*) on the dependent variable, four dummy variables with *HF* established as the base were constructed. The multiple regression analysis indicated that the base variable for cognitive reasoning schemata, *HF*, in the full model was not significantly different from zero because the *F*-statistics for the dummy variables (i.e., *LC*, *HC*, *TRANS*, and *LF*) were not statistically significant (see Table 15). Therefore, the answer to question 4 was no; *the additive effect of the dummy variables for cognitive reasoning schemata did not impact the full model for predicting the incremental change to end users' MOTIVATIONAL INTENT to use computer technology.*

Research Question 5. This question raised the issue of whether individual differences (i.e., age, gender, previous computer experience, and scholastic ability) were important predictors of the incremental change to end users' *MOTIVATIONAL INTENT* (posttest scores minus pretest scores) to use computer technology. SPSS' multiple regression analysis indicated that *scholastic ability*, defined as a *priori* GPA obtained from the Registrar's office, was an important determinant of the incremental change to end users' *MOTIVATIONAL INTENT* to use computer technology ($F = 3.312$, $p < .10$); however, *age*, *gender*, and *previous computer experience* were not significant predictors of the incremental change to end users' *MOTIVATIONAL INTENT* to use computer technology (see

Table 15). The results of a stepwise multiple regression indicated that the regression equation outlined in Table 16 was statistically different from zero ($F = 3.25012$, $p < .10$). The independent variable, *scholastic ability*, explained 2.4% of the variance in the incremental change to end users' **MOTIVATIONAL INTENT** to use computer technology in the partial model (see Table 16).

The answer to research question 5 was yes--end users' *scholastic ability, measured by their a priori GPA, was an important predictor of the incremental change to end users' MOTIVATIONAL INTENT to use computer technology.* However, other individual differences (i.e., age, gender, and previous computer experience) were not important predictors of the dependent variable.

Research Question 7. This question attempted to determine if end users' perceived **ANXIETY** was an important predictor of the incremental change to their **MOTIVATIONAL INTENT** to use computer technology. The multiple regression analysis indicated that **ANXIETY**, was not an important predictor of the dependent variable (see Table 15). Therefore, the answer to question 7 was no; *end users' perceived anxiety was not an important predictor of the incremental change to end users' MOTIVATIONAL INTENT to use computer technology.*

Chapter 5: Discussion and Conclusion

Research indicates that effective and efficient end user training is a vital component of the successful utilization of computer technology (e.g., Bostrom, et al., 1990; Davis & Bostrom, 1993; Rivard & Huff, 1988). Research also suggests that organizations under utilize their computer technology (Davis, et al., 1989) and expend less than 2% of their IS budgets on end-user training (Nelson & Cheney, 1987). Two possible reasons for the low training expenditures: 1) the processes and benefits of end-user training are poorly understood and 2) organizations view the cost of training as an expense rather than an asset (Nelson, 1991). Consequently, additional research is required to advance scientific knowledge in the area of end-user training.

The major objective of this thesis is to explore and test whether findings, theories, and models applied in research investigating the outcomes of end-user training and end users' attitudes regarding computers may also be applied to end users' motivational intent to use computer technology (i.e., an outcome of end-user training). Specifically, this thesis investigates how individual differences (e.g., learning styles, cognitive reasoning level, age, gender, scholastic ability, previous computer experience, and anxiety) effect the incremental change (over a time interval of approximately 10 weeks) to end users' perceived **MOTIVATIONAL INTENT** to use computer technology. This study also investigates the

relationships between end users' perceived **MOTIVATIONAL INTENT**, pretest and posttest, with learning styles, cognitive reasoning schemata, and levels of anxiety.

Discussion Of Results

Training Model. This study provides collaborative evidence for Bostrom et al. (1990) model that the motivation to use computer technology is an outcome of end-user training. More importantly, this study also provides new information regarding the incremental change over time (approximately 10 weeks) to end users' motivational intent to use computers. The statistical results indicate that end users' perceived **MOTIVATIONAL INTENT** to use computer technology increased significantly after receiving 10 weeks of computer instruction. By the end of the semester, end users are more motivated to use computer technology for university assignments, personal tasks, personal budgets, and private correspondences.

Anxiety. The results of this study add new scientific information to the collection of research investigating end users and anxiety. The within-subjects effect of end user's pretest and posttest **MOTIVATIONAL INTENT** differs statistically for end users grouped according to their perceived level of anxiety. Specifically, end users' pretest **MOTIVATIONAL INTENT** to use computer technology is statistically different among the three groups of anxiety (i.e., negative, neutral, and positive); however, after 10 weeks of hands-on computer

instruction end users' **MOTIVATIONAL INTENT** to use computer technology is similar for all three groups of anxiety. This result indicates that one possible method for reducing end users' level of anxiety and increasing the outcome of computer training is to utilize a hands-on computer training method.

Cognitive Reasoning Schemata. Profile analysis of end users' **MOTIVATIONAL INTENT** to use computer technology reveals an interesting finding. The within-subjects effect of end users' pretest and posttest **MOTIVATIONAL INTENT** is positive and statistically different for end users grouped according to their *cognitive reasoning schemata*. During the 10 weeks of training, end users who are grouped by their cognitive reasoning schemata demonstrate a significant increase in their **MOTIVATIONAL INTENT** to use computer technology.

Learning Styles and Scholastic Ability. Another significant finding is that this study also provides early evidence for the Bostrom et al. (1990) end-user training model and for the premise that certain individual differences (i.e., specifically, learning styles and scholastic ability) may play an important role and may effect the incremental change to end users' motivation to use computer technology. The statistical analysis of the data indicates that *scholastic ability* (defined as *a priori* GPA obtained from the Registrar's office) is an important, negative determinant of the incremental change to end users' **MOTIVATIONAL INTENT** to use computer technology; however, gender, age, previous computer

experience, anxiety and cognitive reasoning levels are not important predictors of end users' **MOTIVATIONAL INTENT** to use computer technology.

The regression analysis indicates that a *CR* learning style, compared to *CS* and more than one dominant learning style, is a better predictor of and increases the explanation of the variation in the incremental change to end users' **MOTIVATIONAL INTENT** to use computers. After receiving 10 weeks of computer instruction, *CR* end users are more motivated to use computer technology and the incremental changes to their **MOTIVATIONAL INTENT** to use computer technology are greater than end users whose learning styles are either *CS*, *AR*, *AS*, or more than one dominant learning style.

The relationship between end users' *scholastic ability* (measured by a *priori* GPA) and the incremental change to their **MOTIVATIONAL INTENT** to use computer technology is strong, indirect and negative; the lower a student's *a priori* GPA the greater the motivation to use computer technology. The negative coefficient for the *scholastic ability* variable is moderately surprising. One possible explanation why students with lower *a priori* GPAs experience a greater change to their **MOTIVATIONAL INTENT** to use computer technology is that they find they expect positive benefits from using computers. For example, the development of computer literacy and computer skills facilitate students' efforts to generate course assignments and papers of higher quality, content and visual

appearance. Consequently, students with lower *a priori* GPAs are motivated to use computer technology because they recognize that they will derive positive benefits from using computer technology to complete their university assignments. Another possible explanation is that students with lower *a priori* GPAs, compared to students with higher *a priori* GPAs, may have started the course with less computer literacy and computer skills, therefore, at the beginning of training, they were less motivated to use the computer technology.

The statistical finding of this thesis highlights several important points regarding the relationship between individual differences and the incremental change to end users' **MOTIVATIONAL INTENT** to use computer technology. The list of individual differences analyzed in this thesis is not the complete list of individual differences identified by Bostrom et al. (1990), but a sub-set of that list. The regression equation for the incremental change to end users' **MOTIVATIONAL INTENT** to use computer technology and individual differences (i.e., learning styles, cognitive reasoning schemata, age, gender, previous computer experience, scholastic ability, and anxiety) is not significantly different from zero and only explains 1% of the variance. The explained variance for this data set is low, which indicates that other factors may influence the incremental change to end users' **MOTIVATIONAL INTENT** to use computer technology. For example, Bostrom et al. (1990) suggest that additional individual differences

(e.g., memory, reading/semantic structures, visual structures, intelligence, locus of control, analytic/heuristic traits, work experience, educational background) may influence the outcomes of end-user training. The low explained variance also indicates that factors other than individual differences, for example training methods, computer interface, and characteristics of trainer, may influence end users' motivation to use computer technology (i.e., one of the outcomes of end-user training). The research model for end-user training developed by Bostrom et al. (1990) proposes that training methods and computer systems may directly influence the outcomes of end-user training and that individual differences may interact with the computer system and training methods.

Gender, Age and Previous Computer Experience. Previous research indicates that end users' attitudes regarding computer technology are significantly affected by gender (e.g., Abouserie et al., 1992; Gattiker & Hlavka, 1992; Pommersheim & Bell, 1986), age (e.g., Igbaria & Parasuraman, 1989) and previous computer experience (e.g., Rivard & Huff, 1988). The results of this study do not support the premises that end users' attitude regarding the incremental change to their **MOTIVATIONAL INTENT** to use computer technology is effected by age and previous computer experience. However, this study supplements the collection of research that indicates that previous computer experience (Kahn & Robertson,

1992) and age (Czaja et al., 1989) appear not to be factors which influence end users' diverse attitudes regarding computer technology.

A note of caution regarding the age and previous computer experience results is warranted. Although, these factors appear not to be important determinants of end users' **MOTIVATIONAL INTENT** to use computer technology and the incremental change over time to end users' **MOTIVATIONAL INTENT**, these factors should not be ignored by the designers and instructors of computer programs because they may be important determinants of end users' learning performance. For example, Czaja et al. (1989) report that end users' attitudes towards computer technology are similar for age groups; however, significant differences are present between the age groups and learning performance. Older end users are less effective at learning computer tasks, for example, text-editing (Czaja, et al., 1989).

The results of this empirical study provides additional evidence of a main effect between gender and end users' attitudes regarding computer technology. Specifically, the empirical results indicate that at the beginning of the semester male end users are more motivated to use computer technology. The results also demonstrate that end users who are grouped by gender experience a significant increase in their **MOTIVATIONAL INTENT** to use computer technology. After 10 weeks of computer training, women's **MOTIVATIONAL INTENT** to

use computer technology increased more than men's **MOTIVATIONAL INTENT**. One possible explanation is that men started the computer course with more experience with and knowledge about computers (Harrison & Rainer, 1993); consequently, at the beginning of training, men are more motivated to use computer technology. A very important and encouraging finding is that after receiving 10 weeks of computer training men's and women's **MOTIVATIONAL INTENT** to use computer technology is similar.

Limitations. The design of this research did permit the elimination of generally recognized threats to internal validity and external validity. However, the design of this study limits the generalization of these empirical results. Consequently, one limitation of this study is that the entire population of end users receiving training is not represented by post-secondary students attending a computer course. A student population that may maintain a more positive attitude towards computer technology than employees in the workplace may limit the generalization of the findings of this thesis to end users in an educational setting. The results of this study may not be applicable to employees because of their concern about job security (Gattiker & Hlvaka, 1992), occupational deskilling (Glenn & Feldberg, 1982) and skill obsolescence (Gist et al., 1988). Exploring the research questions raised in this thesis in a work environment may further advance scientific knowledge regarding end users'

motivation to use computer technology. The investigation of additional individual differences may increase our understanding of end users' motivational intent to use computer technology. The author of this thesis acknowledges the limitations of this empirical study; nevertheless, this research did generate significant and important findings.

Practical Implications for Trainers, Educators and Employers

This thesis demonstrates that the individual differences of post-secondary students appear to influence one of the outcomes of end-user training, specifically, their **MOTIVATIONAL INTENT** to use computer technology and the incremental change over time to end users' **MOTIVATIONAL INTENT** to use computer technology. The research findings of this thesis are not conclusive, but the results are important and significant. Therefore, end-user trainers, end-user educators, and managers need to consider the suggested implications with the understanding that the results reported in this thesis still need to be investigated in the workplace.

The empirical results suggest that end users' perceived motivation to use computer technology may not be the same for every individual. For example, anxious end users are the least motivated to use computer technology at the beginning of a computer course. Prior to the commencement of end-user training, computer educators and trainers should use constructs measuring individuals' level of anxiety to identify end users who may be experiencing anxiety towards computer

technology. Gilroy and Desai (1986) recommend that end-user educators and trainers should use a function approach (e.g., using word-processing application to generate documents) to desensitize end users with high levels of anxiety.

The empirical findings of this thesis suggest that learning styles and scholastic ability are important predictors of end users' perceived motivation to use computer technology. Therefore, computer trainers and computer instructors could use learning style instruments (e.g., Gregorc Learning Style Delineator) and the scholastic ability of end users to modify the outcomes of end-user training and to match training methods to individual requirements. This recommendation for matching training methods to individual learning styles is supported by Bostrom et al. (1990) finding that in some circumstances, but not all, the interaction between end users' learning style and training method is significant. For example, Bostrom et al (1990) report that end users who are categorized as having an abstract learning style are more motivated to use computer technology when an application-based training method (i.e., guided instructions are provided to complete job-related problems) is used. Conversely, the use of a construct-based training method (i.e., syntax and function instructions are provided to complete general problems) results in higher motivation to use computer technology for end users whose learning style is categorized as concrete.

Matching the training/instructional methods to the end users' learning styles may increase the outcomes of end-user training. For example, a structured, guided instructional approach may improve the outcomes of training (i.e., motivational intent to use computer technology) for end users whose learning style is CR. Whereas, AR end users and AS end users may benefit more from an abstract training/instructional method that encourages trainees/students to explore and discover computer skills and knowledge on their own (Bostrom et al., 1990). Matching the training method with end users' learning style may enhance of the outcomes of end-user training because end users are using their preferred learning mode.

The results of the Gregorc Style Delineator, ATFR, or a reliable, valid anxiety instrument should be used to create and design segregated computer training sessions for each type of end user. A second potential application of these instruments is to select end users for specific end-user training programs. A third potential application of these instruments is to aid trainers and instructors in developing training methods, training techniques, and training materials to accommodate the various groups of end users when other factors (e.g., cost, time) dictate that segregated end-user training is not a practical or feasible approach. However, a note of caution regarding the use of the Gregorc Style Delineator and the ATFR is required for managers, end-user

trainers and end-user educators; the application of these two instruments should be used cautiously because their validity has not been conclusively established.

The results of this empirical study also suggest potential implications for management. Gattiker (1992) suggests that in the near future many organizations will find that their largest capital asset is computer technology. Research indicates that the investments in computer technology by organizations are risky because employees and managers may resist and/or under utilize computer systems (Davis et al., 1989). Resistance to computer technology has a detrimental effect on end users' performance (Davis, 1993). This study indicates that designers/instructors/trainers need to consider individual differences when designing effective and efficient end-user training programs because end users' responses to computer technology are eclectic and complicated. Tailoring end-user training programs to individual differences could optimize the outcomes of training, and increase end users' acceptance and utilization of computer technology.

Implications for Researchers

From this thesis significant implications for future research emerge. Additional research needs to replicate this study to determine whether the empirical findings regarding the effects of individual differences on end users' motivational intent to use computers and the incremental change over time to end users' motivational intent to use

computers are unique. Subsequent empirical research needs to investigate whether the results of this thesis also apply to the individual differences of employees in the workplace. For example, the research design should investigate whether individual differences (e.g., learning styles, cognitive reasoning schemata, anxiety, age, gender, previous computer experience, scholastic ability) are important determinants of employees' motivational intent to use computer technology and whether employees transfer their computer skills and knowledge from off-the-job training to the workplace.

Post-hoc analysis suggests that important differences between gender groups may exist for end users' motivational intent to use computer technology. For example, men's pretest motivational intent to use computer technology is greater than women's pretest motivational intent. Post-hoc analysis of end users' perceived anxiety suggests that important differences between-groups of various end users (i.e., gender groups and cognitive reasoning groups) may exist. Empirical studies investigating these phenomena are vital. Empirical evidence linking end users' perceived anxiety with gender groups and cognitive reasoning schemata would be useful. For example, specific training programs for various groups of end users could be designed to desensitize anxious individuals.

More research is needed to refine end-user training models and further investigate the complicated relationships between end-users' training outcomes and individual

differences, computer features, training methods, and trainer characteristics. For example, the evaluation of the characteristics of the trainers (e.g., knowledge, gender, age, personality, training philosophy, training goals, training objectives) and how these characteristics influence the outcomes of end-user training would be interesting and challenging.

Conclusion

This thesis tries to respond to the need for new research investigating both the incremental change over time to end users' motivational intent to use computer technology and end users' pretest and posttest motivational intent to use computer technology. This study also tries to respond to the need for additional research investigating the effects of individual differences on end users' motivational intent to use computer technology. This study provides initial evidence that end users' motivation to use computer technology changes over time. This empirical study provides collaborative evidence for the premise that individual differences may influence the outcomes of end-user training, specifically, end users' motivational intent to use computer technology. The results of this study indicate that end users' motivation to use computer technology differs between various groups of computer users.

The designers and trainers of end-user training programs and the educators of computer courses should therefore

consider individual differences (e.g., scholastic ability, level of anxiety, previous computer experience, learning styles, and cognitive reasoning schemata) when developing and designing successful computer training programs/courses or selecting individuals for end-user training programs/courses. Training programs that are developed to accommodate the differences between individuals or the selection of end users to participate in customized computer training programs/courses should enhance the effectiveness of end-user training programs/courses (i.e., end users' motivation to use computer technology). In so doing, end users, educators, trainers, educational institutions, and organizations will all benefit.

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Tables

Table 1

Factor Analysis of Questionnaire Items Used to Define the Dependent Factor - Motivational Intent

Scale Items	Pretest Factor Loadings	Posttest Factor Loadings	Incremental Difference Factor Loadings	Variance Explained Per Factor
I intend to:				
Use the microcomputer for my personal budgeting	.81266	.63594	.58475	
Use the microcomputer for some of my private chores	.82548	.67114	.81744	
Use the microcomputer to do my private correspondence	.59584	.80174	.81252	
Use a word-processor to write all my assignments for other classes/work	.56701	.45599	.61328	26.2%

Note. The above factor analysis was obtained using SPSS. Orthogonal varimax rotations were performed on the data. Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks).

Table 2

Factor Analysis of Questionnaire Items Used to Define the Independent Factor - Anxiety

Scale Items	Pretest Factor Loadings	Posttest Factor Loadings	Incremental Difference Factor Loadings	Variance Explained Per Factor
I believe that working with computers:				
Is very difficult	.83837	.76963	.85947	
Is stressful	.80180	.76794	.66387	
Is very complicated	.85596	.86310	.76669	23.3%

Note. The above factor analysis was obtained using SPSS. Orthogonal varimax rotations were performed on the data. Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks).

Table 3
Factor Analysis of Questionnaire Items Used to Define the Independent Factor - General Computer Literacy

Scale Items	Pretest Factor Loadings	Posttest Factor Loadings	Incremental Difference Factor Loadings	Variance Explained Per Factor
I:				
Believe myself to be computer-literate	.66668	.34748	.67010	
Have some knowledge about computers	.63556	.46938	.64322	
Frequently play games on microcomputers	.74425	.71204	.56110	
Had the opportunity to work with a microcomputer during high school	.71032	.62448	.63118	11.6%

Note. The above factor analysis was obtained using SPSS. Orthogonal varimax rotations were performed on the data. Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks).

Table 4
Reliability Analysis of Questionnaire Items Used to Define the Dependent Factor - Motivational Intent

Scale Items	Pretest Item-total Correlation	Posttest Item-total Correlation	Incremental Difference Item-total Correlation
I intend to:			
Use the microcomputer for my personal budgeting	.6400	.6279	.4434
Use the microcomputer for some of my private chores	.7722	.7085	.6700
Use the microcomputer to do my private correspondence	.6276	.5974	.6548
Use a word-processor to write all my assignments for other classes/work	.4634	.3757	.4110
Cronbach's Alpha	.8068	.7712	.7434

Note. Item-total correlations for the scale was obtained using raw scores for each item ranging from 1 (disagree completely) to 5 (agree completely). The scale was constructed by (1) taking those items which loaded highly (greater than .50) when doing a factor analysis using orthogonal varimax rotations (cf. Comrey, 1973) and (2) averaging the scores obtained from these items. Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks). The incremental difference for Motivational Intent was calculated by subtracting the Motivational Intent posttest scores from the Motivational Intent pretest scores.

Table 5
Reliability Analysis of Questionnaire Items Used to Define the Independent Factor - Anxiety

Scale Items	Pretest Item-total Correlation	Posttest Item-total Correlation	Incremental Difference Item-total Correlation
I believe that working with computers:			
Is very difficult	.8059	.6636	.6384
Is stressful	.7387	.5888	.5128
Is very complicated	.7350	.6870	.5045
Cronbach's Alpha	.8745	.7973	.7278

Note. Item-total correlations for the scale was obtained using raw scores for each item ranging from 1 (disagree completely) to 5 (agree completely). The scale was constructed by (1) taking those items which loaded highly (greater than .50) when doing a factor analysis using orthogonal varimax rotations (cf. Comrey, 1973) and (2) averaging the scores obtained from these items. Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks). The incremental difference for Anxiety was calculated by subtracting the Anxiety posttest scores from the Anxiety pretest scores.

Table 6
Reliability Analysis of Questionnaire Items Used to Define the Independent Factor - General Computer Literacy

Scale Items	Pretest Item-total Correlation	Posttest Item-total Correlation	Incremental Difference Item-total Correlation
I:			
Believe myself to be computer-literate	.5818	.3503	.4385
Have some knowledge about computers	.5592	.4168	.4540
Frequently play games on microcomputers	.5476	.3985	.4058
Had the opportunity to work with a microcomputer during high school	.4688	.4310	.4144
Cronbach's Alpha	.7363	.6048	.6466

Note. Item-total correlations for the scale was obtained using raw scores for each item ranging from 1 (disagree completely) to 5 (agree completely). The scale was constructed by (1) taking those items which loaded highly (greater than .50) when doing a factor analysis using orthogonal varimax rotations (cf. Comrey, 1973) and (2) averaging the scores obtained from these items. Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks). The incremental difference for General Computer Literacy was calculated by subtracting the General Computer Literacy posttest scores from the General Computer Literacy pretest scores.

Table 7
Variable Definition

<u>Dependent Variables - Scales</u>	
MOTIVATIONAL INTENT - PRETEST	At the beginning of the semester, four items measured end users' motivational intent to use computer technology
MOTIVATIONAL INTENT - POSTTEST	At the end of the semester, four items measured end users' motivational intent to use computer technology
MOTIVATIONAL INTENT - IN. DIFF.	Motivational Intent posttest scores minus motivational intent pretest scores
<u>Independent Variables</u>	
Cognitive Traits	
CR	1 if dominant learning style was Concrete Random, 0 otherwise (Base Variable)
CS	1 if dominant learning style was Concrete Sequential, 0 otherwise
AS	1 if dominant learning style was Abstract Sequential, 0 otherwise
AR	1 if dominant learning style was Abstract Random, 0 otherwise
DUMBOTH	1 if more than one dominant learning style, 0 otherwise
Structure Strategies	
LC	1 if cognitive reasoning level was Low Concrete, 0 otherwise
HC	1 if cognitive reasoning level was High Concrete, 0 otherwise
TRANS	1 if cognitive reasoning level was Transitional, 0 otherwise
LF	1 if cognitive reasoning level was Low Formal, 0 otherwise
HF	1 if cognitive reasoning level was High Formal, 0 otherwise (Base Variable)
Descriptive Traits	
GENDER	1 if female, 0 if male
AGE	Actual age of respondent
Previous Computer Experience:	
GPBASIC	Actual number of prior basic computer courses successfully completed by the end user
GENCOMLIT - PRETEST	At the beginning of the semester, four items measured end users' perceived general computer literacy
GENCOMLIT - POSTTEST	At the end of the semester, four items measured end users' perceived general computer literacy
GENCOMLIT - IN. DIFF.	General computer literacy posttest scores minus general computer literacy pretest scores
Scholastic Ability:	
GPAAP	Student's <i>a priori</i> Grade Point Average were obtained from the Registrar's office
Attitude States	
ANXIETY - PRETEST	At the beginning of the semester, three items measured end users' anxiety
ANXIETY - POSTTEST	At the end of the semester, three items measure end users' anxiety
ANXIETY - IN. DIFF.	Anxiety posttest scores minus anxiety pretest scores
POSITIVE	1 if pretest score of anxiety was less than or equal to 2.5
NEUTRAL	2 if pretest score of anxiety was greater than 2.5 and less than 3.5
NEGATIVE	3 if pretest score of anxiety was greater than or equal to 3.5

Note. The variables for the cognitive traits and structure strategies were created using dummy coding. New dummy variables were created and coded in the following manner: if, for example, a subject's dominant learning style was CR then the variable was coded as 1; otherwise, the variable was coded as 0. Dummy variables that were treated as base cases, CR and HF (see Table 8), were deleted from the regression equation. The remaining dummy variables for that group were measured relative to the base case (Jobson, 1991, p. 314-316).

Table 8
Regression Equation

$$\text{MOTIVATIONAL INTENT - IN. DIFF.} = \beta_0 + \beta_1(\text{AR}) + \beta_2(\text{AS}) + \beta_3(\text{CS}) + \beta_4(\text{DUMBOTH}) + \beta_5(\text{LC}) + \beta_6(\text{HC}) + \beta_7(\text{TRANS}) + \beta_8(\text{LF}) + \beta_9(\text{GENCOMLIT - PRETEST}) + \beta_{10}(\text{AGE}) + \beta_{11}(\text{GPAAP}) + \beta_{12}(\text{ANXIETY - PRETEST}) + \beta_{13}(\text{GENDER}) + \beta_{14}(\text{GPBASIC})$$

Note. Explanations for the variables used in the regression equation were outlined in Table 7.

Table 9
Mean and Standard Deviation of Dependent Variables and Independent Variables

Variables	Pretest		Posttest		Incremental Difference	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
<u>Dependent Variables</u>						
MOTIVATIONAL INTENT - PRETEST	3.39	.93				
MOTIVATIONAL INTENT - POSTTEST			3.69	.82		
MOTIVATIONAL INTENT - IN. DIFF.					.30	.91
<u>Independent Variables</u>						
<u>Cognitive Traits</u>						
CR	.11	.31				
CS	.55	.50				
AS	.19	.40				
AR	.13	.34				
DUMBOTH	.03	.18				
<u>Structure Strategies</u>						
LC	.00	.00				
HC	.09	.28				
TRANS	.10	.30				
LF	.65	.48				
HF	.17	.38				
<u>Descriptive Traits</u>						
GENDER	.41	.49				
AGE	23.96	5.22				
GPBASIC	.61	1.30				
GENCOMLIT - PRETEST	2.26	1.01				
GENCOMLIT - POSTTEST			2.56	.76		
GENCOMLIT - IN. DIFF.					.31	.82
GPAAP	2.89	.51				
<u>Attitude States</u>						
ANXIETY - PRETEST	2.92	1.03				
ANXIETY - POSTTEST			2.77	.85		
ANXIETY - IN. DIFF.					-.18	.94

Note. Explanations of the coding employed for the various variables were outlined in Table 8. All missing values using a listwise approach were excluded from the calculations for the values listed above (n = 94).

Table 10
Between-group Mean of Dependent Factors and Independent Factors

Groups	Motivational Intent			Anxiety		
	Pretest Mean(df)	Posttest Mean(df)	Incremental Difference Mean(df)	Pretest Mean(df)	Posttest Mean(df)	Incremental Difference Mean(df)
Learning Styles:						
CS (51)	3.46(64)	3.61(57)	0.23(52)	2.93(64)	2.76(56)	-0.20
AS	3.29(21)	3.53(23)	0.29(18)	2.86(21)	2.71(23)	-0.07(18)
AR	3.38(15)	3.71(13)	0.35(12)	2.90(16)	2.62(13)	-0.31(13)
CR	3.47(17)	4.00(11)	0.68(10)	2.77(16)	2.73(11)	-0.07(10)
DUMBOTH	4.25(4)	3.88(4)	-0.42(3)	3.42(4)	3.50(4)	-0.22(3)
Cognitive Reasoning Levels:						
LC	0.00(0)	3.00(1)	0.00(0)	0.00(0)	4.00(1)	0.00(0)
HC	3.27(15)	3.60(10)	0.31(9)	3.43(14)	3.50(10)	-0.04(9)
TRANS	3.59(14)	3.65(10)	0.56(9)	2.79(14)	2.63(10)	0.26(9)
LF	3.46(71)	3.67(68)	0.20(60)	2.96(72)	2.71(68)	-0.30(61)
HF	3.44(21)	3.67(19)	0.43(17)	2.48(21)	2.52(18)	-0.06(16)
Gender:						
MEN	3.62(74)	3.74(65)	0.16(57)	2.83(74)	2.69(64)	-0.11(56)
WOMEN	3.18(47)	3.53(43)	0.46(38)	3.03(47)	2.85(43)	-0.27(39)
Level of Anxiety:						
POSITIVE	3.49(46)	3.68(38)	0.17(37)			
NEUTRAL	3.68(37)	3.79(28)	0.20(28)			
NEGATIVE	3.18(37)	3.60(30)	0.50(30)			

Note. Explanations of the coding employed for the various variables and groups were outlined in Table 7. All missing values were excluded from the calculations for the values listed above. The incremental difference for Motivational Intent (Anxiety) was calculated by subtracting the Motivational Intent (Anxiety) posttest scores from the Motivational Intent (Anxiety) pretest scores.

Table 11
t-Test of Dependent Factor and Independent Factor

Factor	Mean	Standard Deviation	t Value	df
<u>Dependent Factor:</u>				
Motivational Intent - Posttest	3.6842	.820	3.01**	94
Motivational Intent - Pretest	3.4026	.936		
<u>Independent Factor:</u>				
Anxiety - Posttest	2.7579	.850	-1.86*	94
Anxiety - Pretest	2.9368	1.009		

Note. The four factors were constructed by averaging scores for each item ranging from 1 (disagree completely) to 5 (agree completely). Pretest questionnaires were completed at the beginning of the semester and posttest questionnaires were completed at the end of the semester (a time interval of approximately 10 weeks). The t-test compared the paired samples for the dependent factor and the paired samples for the independent factor.

* one-tail $p < .05$
 ** one-tail $p < .01$

Table 12
Profile Analysis for Motivational Intent and Anxiety Factors

Between-group	SS	df	MS	F
Motivational Intent:				
Learning Styles:				
Between-group Effect	1.80	4, 90	.45	.39
Within-subjects Effect	1.08	1, 90	1.08	2.59
Learning Styles X Motivational Intent Interaction	1.62	4, 90	.40	.97
Cognitive Reasoning Level:				
Between-group Effect	.50	3, 91	.17	.14
Within-subjects Effect	3.70	1, 91	3.70	8.74**
Reasoning Level X Motivational Intent Interaction	.74	3, 91	.25	.58
Gender:				
Between-group Effect	5.47	1, 93	5.47	5.05*
Within-subjects Effect	4.42	1, 93	4.42	10.77***
Gender X Motivational Intent Interaction	1.01	1, 93	1.01	2.47
Anxiety:				
Between-group Effect	3.58	2, 92	1.79	1.60
Within-subjects Effect	3.90	1, 92	3.90	9.40**
Anxiety X Motivational Intent Interaction	1.05	2, 92	.53	1.27
Anxiety:				
Learning Styles:				
Between-group Effect	4.98	4, 90	1.25	.96
Within-subjects Effect	.65	1, 90	.65	1.42
Learning Styles X Motivational Intent Interaction	.29	4, 90	.07	.16
Cognitive Reasoning Level:				
Between-group Effect	11.51	3, 91	3.84	3.16*
Within-subjects Effect	.03	1, 91	.03	.07
Reasoning Level X Motivational Intent Interaction	1.47	3, 91	.49	1.12
Gender:				
Between-group Effect	2.75	1, 93	2.75	2.14
Within-subjects Effect	1.72	1, 93	1.72	3.87*
Gender X Motivational Intent Interaction	.30	1, 93	.30	.67

Note. SPSS' Manova, based on a between-within design, was used for the Profile Analysis of the dependent variable. The MOTIVATIONAL INTENT scale was constructed by averaging scores for each item ranging from 1 (disagree completely) to 5 (agree completely). The dependent variable, MOTIVATIONAL INTENT, was measured repeatedly (at the beginning of the semester and at the end of semester) on the same scale (Tabachnick & Fidell, 1989, p. 437-488).

A Greenhouse-Geiser adjustment was used to test for violation of homogeneity of covariance (Tabachnick & Fidell, 1989). The Greenhouse-Geiser adjusts the degrees of freedom of the F ratio (SPSS Inc., 1990). The results of the Greenhouse-Geiser were not reported because the F ratios remained significant.

* $p < .05$

** $p < .01$

*** $p < .001$ or $p = .001$

Table 13
Univariate Analysis of Variance for Motivational Intent and Anxiety Factors

Between-group	Variable	Pretest		Posttest	
		F	df	F	df
<u>Learning Styles:</u>					
	Motivational Intent	.978	4, 116	.738	4, 103
	Anxiety	.349	4, 116	.839	4, 102
<u>Cognitive Reasoning Level:</u>					
	Motivational Intent	.314	3, 117	.177	4, 103
	Anxiety	2.818*	3, 117	3.009*	4, 102
<u>Gender:</u>					
	Motivational Intent	7.047**	1, 119	1.781	1, 106
	Anxiety	1.092	1, 119	.877	1, 105
<u>Anxiety Level:</u>					
	Motivational Intent	3.043*	2, 117	.370	2, 93

Note. SPSS* ANOVA compared the groups on one scale at a time. The pretest and posttest scales were constructed by averaging scores for each item ranging from 1 (disagree completely) to 5 (agree completely).

* $p < .05$ or $p = .05$

** $p < .01$

Table 14
Correlation Coefficients of Independent Variables Included in the Final Equations

Variables	MOTIVATIONAL INTENT IN. DIFF.	AS	AR	CS	DUMBOTH	LC	HC	TRANS	GENERAL LF	COMLIT	AGE	GPAAP	GP- ANXIETY	GENDER	BASIC
MOT. IN.	1.000														
AS	-.007	1.000													
AR	.021	-.189*	1.000												
CS	-.001	-.540	-.424	1.000											
DUM	-.145	-.089	-.070	-.201*	1.000										
LC	.000	.000	.000	.000	.000	1.000									
HC	.035	.044	-.004	-.030	-.056	.000	1.000								
TRANS	.091	-.160	-.017	.224*	-.060	.000	-.100	1.000							
LF	-.161	-.092	.017	.004	.135	.000	-.414***	-.414***	1.000						
GENCOM.	.050	.183*	-.125	-.026	-.124	.000	-.042	.041	-.012	1.000					
GPAAP	-.186*	-.030	-.266**	.221*	-.002	.000	-.205*	.018	.134	-.226*	.199*	1.000			
CPHOBIA	.071	-.123	.028	.081	.112	.000	.209*	-.118	.077	-.352***	-.157	.187*	1.000		
GENDER	.144	-.020	-.059	.139	-.152	.000	.213*	.172*	-.115	.005	-.145	.045	.189*	1.000	
GPBASIC	.002	.230**	-.009	-.154	-.086	.000	-.116	.042	.039	.432***	.078	-.009	-.154	-.089	1.000

Note. Explanations of the coding employed for the various variables and groups were outlined in Table 7.

* $p < .05$
 ** $p < .01$
 *** $p < .001$

Table 15
Multiple Regression Analysis - Association Between the Various Independent Variables and the Incremental Change to Motivational Intent

Independent Variable	B	Beta	F	t	Multiple R	R Square	Adjusted R Square
GPBASIC	-.001581	-.002265	.000	-.019			
GPAAP	-.392796	-.218738	3.312*	-1.820*			
TRANS	.069773	.407639	.029	.171			
DUMBOTH	-1.195375	-.233472	3.681*	-1.918*			
AGE	-.003522	-.021370	.035	-.186			
HC	-.493725	-.153034	1.346	-1.160			
AS	-.559805	-.244485	2.236	-1.495			
AR	-.635664	-.235564	2.366	-1.538			
GENDER	.218773	.118882	1.080	1.039			
ANXIETY - PRETEST	.151896	.172586	1.973	1.405			
GENCOMLIT - PRETEST	.024268	.026905	.042	.205			
LF	-.325013	-.171902	1.494	-1.222			
CS	-.604673	-.332643	3.243*	-1.801*			
Multiple Regression Equation			1.06976		.38689	.14969	.00976

Note. Explanations of the coding employed for the various variables and groups were outlined in Table 7. All variables for the regression equation were forced into the equation in a single step (n = 93).

- * p < .10
- ** p < .05
- *** p < .01

Table 16
Stepwise Multiple Regression Analysis - Association Between the Various Independent Variables and the Incremental Change to Motivational Intent

Independent Variable	B	Beta	F	t	Multiple R	R Square	Adjusted R Square
GPAAP	-.333465	-.185699	3.250*	-1.803*			
Multiple Regression Equation			3.25012*		.18570	.03448	.02387

Note. Explanations of the coding employed for the various variables and groups were outlined in Table 7. Each variable was examined at each step of the regression analysis to determine which variables should enter the equation (n = 93).

- * p < .10
- ** p < .05
- *** p < .01

APPENDICES

Appendix A: Canadian Trends and Statistics

Computer Technology and Computer Literacy

Several contemporary Canadian studies investigated the extent of computer use in the workplace (Lowe, 1991; Statistics Canada, 1992) and the level of computer literacy among Canadians (Lowe, 1990; Statistics Canada, 1992). These statistical studies highlighted a number of interesting and important points regarding the use of computer technology. In 1989, approximately 4.3 million Canadians used computers in their occupations (Lowe, 1991). These statistics indicated a direct relationship between the level of an employee's education and the likelihood of that employee using a computer in the workplace. Employees with advanced education use computer technology in their jobs more than individuals with less education; 55% of employees with university degrees used a computer at work, whereas, only 12% of employees with less than a high school diploma used a computer at work (Lowe, 1991).

Canadian statistical studies also highlighted a number of interesting, relevant and important findings regarding the prevalence of computer literacy among Canadians (Lowe, 1990; Statistics Canada, 1992). The percentage of computer literacy in Canada varied depending upon the end users' age: the prevalent age group was teenagers at 82%; adults between 20 and 44 years of age were second, ranging from 66% for 20 to 24

year olds to 56% for 35 to 44 years old; and, older Canadians were the least prevalent group using computers, ranging from 38% for 45 to 55 year olds to 6% for individuals over the age of 65 (Lowe, 1990). Other points of interest included: 1) the computer knowledge of individuals varied greatly among different occupations, and 2) the level of computer literacy of end users in occupations employing large numbers of employees (e.g., nursing, transportation, services) was low (Lowe, 1990).

Computer Training. Several Canadian studies also investigated trends in computer training (Betcherman, Newton, & Godin, 1990; Crompton, 1992; Lowe, 1990; Newton, de Brouchker, Mcdougall, McMullen, Schweitzer, Siedule, 1986; Simpson, 1983). Lowe (1990) indicated that computer training was important because society has become increasingly dependent on computer technology; consequently, Canadians need to be computer literate. Two-thirds of all computer literate Canadians (6.4 million people) participated in formal training programs (e.g., computer course) to acquire their computer skills (Lowe, 1990). A finding of concern was that older Canadians, who were deemed the least computer literate, participated the least in computer training programs to acquire computer skills (Lowe, 1990). A direct, positive relationship between an individual's level of education and computer training was demonstrated; 57% of Canadians with

university degrees completed at least one computer course
(Lowe, 1990).

Appendix B: Theoretical Model

End-user computer training has attracted considerable attention and energy by the education, management, MIS, and psychology research communities (e.g., Brancheau & Wetherbe, 1987; Davis et al., 1989; Davis & Bostrom, 1993; Niederman et al., 1991; Panko, 1987). However, limited empirical research has investigated what factors contributed to increased learning (Niederman et al., 1991) and how to design an effective training program (Davis & Bostrom, 1993). Another criticism of this published literature was that information which linked end-user computer training to conceptual theories and/or paradigms was limited (Gattiker, 1992) and/or atheoretical (Steiner et al., 1991).

Importance of Training

Research stressed that the maximum utilization of end-user computing required end users to develop a competent level of knowledge about computer hardware and software and to be motivated to use the computer technology (Bostrom et al., 1990). White and Christy (1987) reported that basic and advanced computer training was the key to efficient and effective end-user computing. Organizations received a positive benefit when middle and top management and support staff were provided with appropriate computer training (Nelson & Cheney, 1987). Because the business community witnessed such an exponential growth of non-professional end users who utilized computer technology to perform a variety of job

functions, end-user computer training became an important issue to management (Brancheau & Wetherbe, 1987).

Research provided evidence that a relationship between computer-related training and a manager's computer-related ability and acceptance of computer technology appeared to exist (Nelson & Cheney, 1987). Nelson and Cheney (1987) reported that a positive relationship existed between computer-related training and the end user's ability to use a computer. Nelson and Cheney (1987) also deduced that a positive relationship existed between end users' acceptance of computer technology and their computer-related abilities. Therefore, end-user training was identified as a key factor in ensuring the successful utilization of computer technology (Davis & Bostrom, 1993). Of importance was the finding by Panko (1987) that management, IS departments, trainers, and educators must consider and overcome two major challenges: 1) the differences which exist between end users and 2) the divergent activities performed by the end users.

Training Model

Recently, some MIS studies responded to the shortage of empirical research by advancing several theoretical models which link end-user training to conceptual paradigms (e.g., Bostrom et al., 1990; Davis & Bostrom, 1993; Nelson & Cheney, 1987). These paradigms integrated theory and research material from cognitive psychology, educational psychology, management, and MIS. Research suggested that effective

computer training resulted in two training outcomes: improved learning performance and positive perceptions about computer technology (Bostrom et al., 1990; Davis & Bostrom, 1993; Sein et al., 1987). The training outcomes were a multiplicative consequence of the end user's motivation and ability (Wexley, 1984). Additional research indicated that the training outcomes of end users were influenced by three diverse components: 1) characteristics of the trainee (individual differences); 2) characteristics of computer technology (target system); and 3) end-user training methods (Bostrom et al., 1990; Davis & Bostrom, 1993; Sein et al., 1987).

Mental Maps. Research defined a user's mental model as the individual's internalized, conceptual comprehension and depiction of computer technology and its related applications (Bostrom et al., 1990; Sein et al., 1987; Staggers & Norcio, 1993). The theoretical model developed by Bostrom et al. (1990) suggested that the training outcomes for end users were a sequence of simple mental models which were subsequently transformed into increasingly more complex mental models. End users constructed mental models of computer technology, either in combination or in isolation, in three ways: 1) mapping via usage, 2) mapping via analogy, and 3) mapping via training (Bostrom et al., 1990). Individual differences played an essential role in the transformation of end users' mental models of computer technology by influencing their mapping via training and mapping via usage processes (Bostrom et al.,

1990). Individual differences were also a major component of the mapping via analogy process (Bostrom et al., 1990).

Research indicated that end users experienced high task performance when they developed a correct mental model of the computer system, which was related consistently to an accurate human-computer interaction (Bostrom et al., 1990; Sein et al., 1987). Gist et al. (1988) reported that compared to a non-modelling method of training, programs that implemented behavioural modelling resulted in end users who developed superior software application skills. Training was effective when end users were motivated to use the computer technology and were taught to develop an accurate mental model of the human-computer interface (Bostrom et al., 1990).

In recent years, literature published in educational psychology and management suggested that individual differences were a source of variance for training outcomes (e.g., Gattiker & Hlavka, 1992; Snow, 1986). More specifically, research indicated that individual differences (e.g., learning styles, anxiety, previous experience) played a role in end users' learning curves of computer software (Bostrom et al., 1990; Wexley, 1986). Snow (1986) reported that individual differences appear to be directly related to end users' learning performance. Other research examined how individual differences, for example, learning styles (Bostrom et al., 1990; Davidson et al., 1992), and various training methods (Bostrom et al., 1990) effected the training outcomes

for end users. The findings of these studies indicated that individual differences do effect end users' attitudes and learning performance. Bostrom et al. (1990) stressed that training methods matched to individual differences will result in effective training for the end user.

Bostrom et al. (1990) outlined four elements of individual differences: 1) *states*, 2) *structures-strategies*, 3) *cognitive traits*, and 4) *descriptive traits*. The *states* (dynamic perspectives) component was comprised of two variables: the end user's attitude/anxiety about computers and the end user's attitude towards his/her job (Bostrom et al., 1990). The *structures-strategies* (both dynamic and enduring mental processes) component was comprised of five variables: memory, reading/semantic, reasoning, skills, and vision (Bostrom et al., 1990). The *cognitive traits* (static preferences of information processing) component included six variables: analytic/heuristic skills, field dependency, intelligence, locus of control, preferred mode of learning, and perceived/tested task knowledge (Bostrom et al., 1990). The *descriptive traits* (characteristics of an end user) component included ten variables: age, educational background, experience with specific software, grade point average, overall computer experience, sex, typing speed, work experience, and years of education (Bostrom et al., 1990).

Outlined in Figure 2 is a modified version of Bostrom et al. (1990) end-user training model. To investigate the

relationship between individual differences and training outcomes, two components of the model are held constant: the target system (IBM machines with DOS operating system) and the training method (lecture and interactive instructional style). By holding the two components constant, the effects of the variables for individual differences can be isolated, thus allowing for the examination of potential effects and interactions that may exist between the independent variables for individual differences and the dependent variable, end users' perception of the system (motivational intent to use the computer technology).

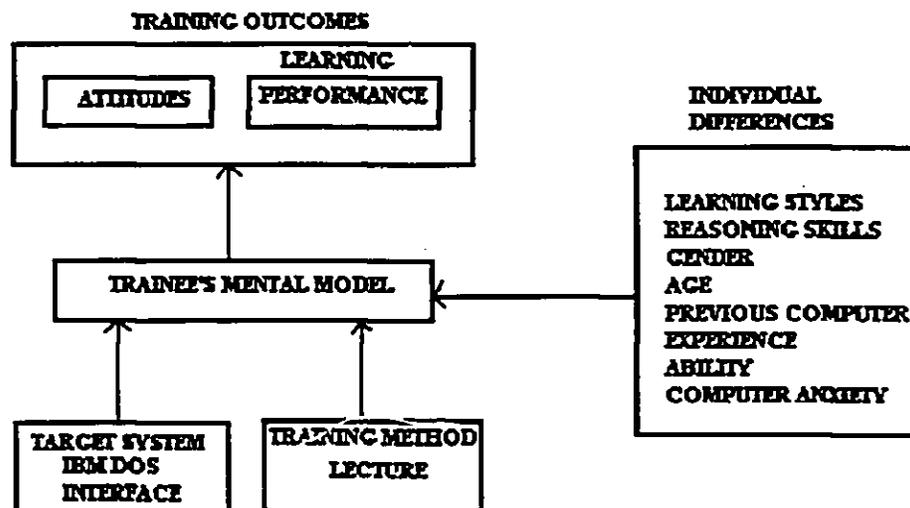


Figure 2. Modified Research Model for End-User Training (Bostrom, Olfman, & Sein, 1990)

In an initial explorative study of their model, Davis and Bostrom (1993) found that different training methods, for example, instruction vs exploration, did not influence training outcomes. However, Davis and Bostrom (1993) reported

that end users employing a direct manipulation interface (e.g., mouse and icon application software) performed better than end users using a command-based interface (e.g., DOS).

Appendix C: Copy of Course Outlines

UNIVERSITY OF LETHBRIDGE

SCHOOL OF MANAGEMENT

Spring Term 1987

Management 3060

- Information Systems I

CONTENT

- This is an introductory course in computer literacy. The primary objective is to provide students with an understanding of the concepts, terminology and issues associated with the use of computers in management. Through laboratory sessions, running in parallel, students acquire a working knowledge of several application software packages using an IBM PC.

INSTRUCTOR

- Dilbagh S. Broca (Doug)
School of Management
Office: E-592
Telephone: 329-2672

TIME & PLACE

- Room : P-207D
Tuesdays, Thursdays: 10:50 a.m. - 12:05 p.m. (A)
5:30 p.m. - 6:45 p.m. (B)
Laboratory Sessions: E-575

PREREQUISITES

- Introductory Accounting (MA 2100)
Managerial Accounting (MA 2400)

TEXT & MATERIALS

- Information Systems I - Laboratory Manual, Ver. 6.0, Fall 1986, available from the Management Office.

H.J. Lucas, Introduction to Computers and Information Systems, Macmillan, New York, 1986.

Information Systems I - Readings Package, Ver. 1.0, Fall 1986, available from the Management Office.

2 double sided, double density, 48 tpi, soft sector diskettes, available from the Management Office.

COURSE SCHEDULE

- Attached

LABORATORY CONTENTS

- IBM PCDOS (the disk operating system)
 Lotus 1-2-3 (a spreadsheet/financial simulation package)
 BASIC (a simple programming language)
 Word Perfect (a word processor)
 dBASE III+ (a database management system)
 FCC General Ledger (accounting system)

(See Andrea Spackman, E-580, for details)

GRADING

- Class:	Mid-term	25%
	Final	25%
		<u>50%</u>
Lab:	Mid-term - practical	10%
	- written	10%
	Final - practical	10%
	- written	10%
	Assignments	<u>10%</u>
		50%

UNIVERSITY OF LETHBRIDGE

SCHOOL OF MANAGEMENT

Summer Term 1987

Management 3060

- Information Systems I

CONTENT

- This is an introductory course in computer literacy. The primary objective is to provide students with an understanding of the concepts, terminology and issues associated with the use of computers in management. Through laboratory sessions, running in parallel, students acquire a working knowledge of several application software packages using an IBM PC.

INSTRUCTOR

- Dilbagh S. Broca (Doug)
School of Management
Office: E-592
Telephone: 329-2672

TIME & PLACE

- Room : E-726
- Monday thru Thurs. : 9:00 - 10:15 a.m.
Laboratory Sessions: E-575

PREREQUISITES

- Introductory Accounting (MA 2100)
Managerial Accounting (MA 2400)

TEXT & MATERIALS

- Information Systems I - Laboratory Manual, Ver. 6.0, Fall 1986, available from the Management Office.

J.A. O'Brien, Computers in Business Management, Richard D. Irwin, Homewood, Illinois, 1985.

2 double sided, double density, 48 tpi, soft sector diskettes, available from the Management Office.

A number of handouts on various topics will be distributed during the term.

COURSE SCHEDULE

- Attached

LABORATORY CONTENTS

- IBM PCDOS (the disk operating system)
- Lotus 1-2-3 (a spreadsheet/financial simulation package)
- BASIC (a simple programming language)
- Word Perfect (a word processor)
- dBASE III+ (a database management system)
- FCC General Ledger (accounting system)

(See Andrea Spackman, E-580, for details)

GRADING

- Class:	Surprise Quizzes	50%
Lab:	Mid-term - practical	10%
	- written	10%
	Final - practical	10%
	- written	10%
	Assignments	10%
		<u>50%</u>

INFO SYSTEMS I
MIDTERM EXAM
Mar 1987

Name _____
Machine # _____

Practical Section
Time: 75 minutes
Open Book

DOS (5 marks)

- 1) Create a DOS batch file which uses replaceable parameters with the DIR command.
- 2) Set the printer to echo. Execute the batch file with the parameter of B:. type the contents of the file.
- 3) Rename the batch file

123 (15 marks) Use 123 to create a 12 month business budget beginning Jan 1987. The following information is for Dec 1986:

Sales	\$100,000
Cost of Sales	45,000
Rent	3,500
Utilities	450
Payroll	10,000
Taxes	50% of (Sales-Expenses)

Inflation is set at .5% per month for Utilities. Sales and Cost of Sales will remain the same each month. In June a special expense - City Business License will be incurred at \$250. Put the information in good spreadsheet format. Include subtotals for income and expenses and calculate a net surplus/deficit. Hand in a printout of the spreadsheet. Assume that the inflation rate will be .6% instead of .5% and that rent will be 4,500 for the year. Hand in the second printout.

BASIC (10 marks) Write a program that will split earnings between the four partners in a firm. The earnings should be input from the keyboard and the split should be printed by the following guide:

BOB	30%
CAROL	15%
TED	20%
ALICE	35%

The program should loop (WITHOUT USING GOTOS) back to the beginning. Try earnings of 1,000, 2500 and 3567. Hand a listing of your program and a sample run.

UNIVERSITY OF LETHBRIDGE

SCHOOL OF MANAGEMENT

Fall 1987

Management 3060

- Information Systems I

CONTENT

- This is an introductory course in computer literacy. The primary objective is to provide students with an understanding of the concepts, terminology and issues associated with the use of computers in management. Through laboratory sessions, running in parallel, students acquire a working knowledge of several application software packages using an IBM PC.

INSTRUCTOR

- Dilbagh S. Broca (Doug)
School of Management
Office: E-592
Telephone: 329-2672

TIME & PLACE

- Room : B-716
- Tues. and Thurs. : 10:50 - 12:05 a.m. (A)
: 5:30 - 6:45 p.m. (B)
Laboratory Sessions: E-575

PREREQUISITES

- Introductory Accounting (MA 2100)
Managerial Accounting (MA 2400)

TEXT & MATERIALS

- Information Systems I - Laboratory Manual, Ver. 6.0, Fall 1986, available from the Management Office.

J.A. O'Brien, Computers in Business Management,
Richard D. Irwin, Homewood, Illinois, 1985.

2 double sided, double density, 48 tpi, soft
sectored diskettes, available from the
Management Office.

A number of handouts on various topics will be
distributed during the term.

COURSE SCHEDULE

- Attached

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- Lotus 1-2-3 (a spreadsheet/financial simulation package)
- BASIC (a simple programming language)
- Word Perfect (a word processor)
- dBASE III+ (a database management system)
- FCC General Ledger (accounting system)

(See Andrea Spackman, E-580, for details)

GRADING

- Class:	Surprise Quizzes	20%
	Final Exam	<u>30%</u>
		50%
Lab:	Mid-term - practical	10%
	- written	10%
	Final - practical	10%
	- written	10%
	Assignments	<u>10%</u>
		50%

MANAGEMENT 3060
MIDTERM FALL 1987
LAB 4

DOS (5 MARKS)

Set the printer to echo your work in DOS and hand in a copy of the printout. Using the COPY command, copy all the files from the DOS disk which have 3 letter filenames to the given disk. Erase all files which begin with the letter D from the given disk.

LOTUS 123 (a) (15 MARKS)

On the given diskette is a spreadsheet named MID1.WKS. You are the landlord of several apartment buildings and you are going to use this spreadsheet to forecast your income to the year 1995. Calculate your total income, expenses and net profit. Project your values to the year 1995. Rent increases by 10% per year and repairs increase by 75% per year. Format your numbers and make the best use of your time with the copy command and formulas. Hand in a printout of the spreadsheet. In what year will you start decreasing your net profit? _____ Suppose you change the rent to increase by 25% per year. Hand in a printout of the spreadsheet with the new values. Now, in what year do you start decreasing your net income? _____

Lotus 123 (b)

On the given diskette is a file called MID3.WKS which contains student consulting information (COMPANY, NAME and PHONE). Sort the students by YEAR+NAME. Extract the NAME, and PHONE for those students who are not in year 1. (>1). Hand in a printout of your spreadsheet showing the sorted database, extracted students and criterion range in TEXT format.

Word Perfect (10 MARKS)

On the given disk is a file called TEXT.WP. Make the following changes to the text:

1. Put a title page with the text BIRTH OF THE COMPUTER centered and using font 8 at the top of the text. Centre this page top to bottom.
2. Move the last paragraph up to become the second paragraph.
3. Replace all references to Turring with the correct name-Turning.
4. Double space the text.
5. Put a page number on the bottom centre of the second page which should read as page # 1.
6. Hand in a printout of the two pages.

MANAGEMENT 3060
FINAL FALL 1987
LAB 1

SAVE ALL YOUR WORK ON THE GIVEN DISK

BASIC (10 MARKS)

The formula to calculate the volume of a cylinder is:

$$\text{VOLUME} = 22/7 * \text{RADIUS}^2 * \text{HEIGHT}$$

Write a program which will prompt the user for an input of RADIUS and HEIGHT and then calculate the VOLUME. The program should print (to the printer) the VOLUME, RADIUS and HEIGHT and then loop (do not use a goto statement) until a radius of 0 is entered. Hand in a printout of your program and a sample run with the following data:

Radius=4
Height=10

Radius=25.3
Height=16

dBASEIII+ (10 MARKS)

On the given disk is a database file called ENROLL.DBF. This database contains the records of students in several courses.

1. Hand in a printout of the structure.
2. Hand a printout of all the records.
3. Use the REPLACE command to add 5 marks to the final GRADE of everyone in the ART class. Copy the command as it appears on the command line to this page:

4. Index the database by CLASS+STNUM.
5. Find the record for STNUM=123456 .AND. CLASS="MATH". Edit the record to change his GRADE to 87.
6. Index the database by GRADE.
7. Add another record to the database:
STNUM CLASS GRADE
555444 ART 76
8. List (on the printer) only those records which have a GRADE>75. Hand in the printout.
9. Make a report grouped by CLASS and subgrouped by STNUM which shows GRADEs for all records. Do not total the GRADEs, put on a title and headings. Hand in a printout of the report.

CHOOSE ANY ONE OF THE FOLLOWING: (5 MARKS)

DOS (5 MARKS)

Make a batch file that will execute the DATE and TIME commands and then give a directory a specified disk. Use a replaceable parameter to specify the disk. Hand in a printout of the batch file and a sample run using the parameter.

LOTUS 123 (5 MARKS)

On the given diskette is a spreadsheet named FIN1.WKS. You are now selling 10 units a day at a price of \$40.00 each. You would like to maximize your sales. You know that for every \$5 decrease in price you will sell 10 more units. Calculate the sales for prices decreasing by \$5 from \$40 to \$0. What is the price that will give you the maximum sales? _____ Hand in a printout of the spreadsheet.

WORD PERFECT (5 MARKS)

Use the Merge commands in Word Perfect to create the following form letter which should:

- 1) be centred top to bottom
- 2) have underlining and bolding where shown

Dear <Name>,

You are invited to a pot luck supper at my house on Friday the 13th of December. Please bring your appetite and <Food>. We'll see you there.

Love and Kisses,
Gree C. Spoon

Use the following database of names and foods and hand in printouts of the merged letters:

John	Bill	Suzy
hotdogs	potato chips	pop

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SCHOOL OF MANAGEMENT

Spring 1988

Management 3060

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(See Andrea Spackman, E-580, for details)

GRADING

- | | | |
|----------|------------------|------------|
| - Class: | Surprise Quizzes | 20% |
| | Final Exam | <u>30%</u> |
| | | 50% |

ASSIGNMENTS

The following section contains the assignments to be completed during the course.

Breakdown:

DOS	1
LOTUS 123	3
BASIC	2
Word Perfect	2
dBASE III+	2

Total	10

Appendix D: Gregorc Style Delineator

Theory of the Gregorc Style Delineator

Gregorc (1979) divided the learning styles of individuals into four basic mediation channels: concrete sequential, abstract sequential, abstract random, and concrete random. Gregorc (1979) indicated that individuals shared the same basic amount of each mediation channel; consequently, people were able to understand and relate to each other. However, people were different and individualistic because they demonstrated a predisposition to one or more of the mediation channels, which constituted their dominant learning style (Gregorc, 1979). Gregorc (1979) identified two types of individuals: individuals who were able to develop and use all four learning styles (labelled by Gregorc as broad-minded) and individuals who utilized only one of the four learning styles (labelled by Gregorc as narrow-minded).

Gregorc (1979) outlined several frames of references for each of the four learning styles:

- 1) Concrete Sequential (CS) Learners. Individuals whose dominant learning style was CS were characterized as pragmatic, methodical, deliberate, stable, quiet, practical, and totally aware of their physical senses. CS individuals were instinctive in their thinking and preferred learning in a progressive, sequential, step-by-step, linear manner. CS' preferred learning environment was orderly and quiet with information presented in an orderly, no-nonsense, efficient

manner (Davidson et al., 1992). CS individuals preferred to follow directions.

2) Concrete Random (CR) Learners. Individuals whose dominant learning style was CR preferred to work independently or in small groups because they examined, disassembled, and modified the information presented to them. These individuals were characterized as intuitive, instinctive, impulsive, and independent. CR learners preferred to learn in an environment that was free from restriction and that was competitive and stimulus-rich (Gregorc, 1979).

3) Abstract Sequential (AS) Learners. Individuals whose dominant learning style was AS were characterized as correlative, analytical, logical and intellectual. Their preferred learning environments were non-authoritative, orderly, quiet, and mentally stimulating and they preferred learning information which was presented in a sequential, structured manner full of details and images. AS individuals preferred a concrete, reality-based world of symbols, thoughts, and abstractions (Davidson et al., 1992). AS individuals also possessed high verbal skills and were capable of separating relevant information from irrelevant information.

4) Abstract Random (AR) Learner. Individuals whose dominant learning style was AR were characterized as emotional, psychic, critical, and perceptive. AR's world of reality was an abstract world of feeling and emotion. AR's

preferred learning environment was vibrant, sensitive-rich, active and colourful. ARs preferred learning in a group setting where the learning information was presented in an unstructured manner. AR individuals randomly built themes from the quintessence of ideas presented to them.

Construct Validity and Reliability Concerns

Research has criticized Gregorc's assessment instrument for determining cognitive styles for construct reliability and validity issues (e.g., Joniak & Isakesen, 1988; O'Brien, 1990). Joniak and Isaksen (1988) concluded that the Gregorc Style Delineator was psychometrically weak (Cronbach's alpha coefficients ranging from .23 to .66) and recommended that the instrument be modified and reanalyzed. Conversely, O'Brien (1990) indicated that the Gregorc Style Delineator satisfied the minimum requirements for factor definition and was moderately reliable (Cronbach's alpha coefficients ranging from .51 to .64). O'Brien (1990) concluded that the concrete sequential, concrete random, and abstract sequential models were defensible measurement models, but the abstract random was not a defensible measurement model. A final verdict regarding the reliability and validity of the Gregorc Style Delineator has not been reached.

Despite the shortcomings of the Gregorc Style Delineator, this thesis utilized the construct to determine the learning styles of management students for two reasons. Research findings regarding the psychometric limitations of the Gregorc

Style Delineator were inconsistent. Bostrom, Olfman and Sein (1993) argued that the research community cannot suspend investigation of important issues because of the psychometric limitations of various construct; instead, the convention of the social science research community was to utilize the best available instrument.

The author of this thesis acknowledges the psychometric limitations of the Gregorc Style Delineator and realizes that additional research investigating the reliability and validity of this construct is necessary.

Appendix E: Arlin Test of Formal Reasoning

Theory of the ATFR

The Arlin Test of Formal Reasoning (ATFR) was a paper and pencil test developed in 1984 by Arlin. The ATFR was designed to provide a less time consuming, more convenient, valid and consistent assessment of an individual's stages of reasoning development (Santmire, 1985). The ATFR was designed to be administered either on an individual basis or on a large group basis (Arlin, 1984). The purpose of the ATFR was fourfold: 1) to assess students' levels of cognitive development, ranging from "concrete" or "abstract-formal"; 2) to assess students' ability to use the "eight formal operational schemata"; 3) as a screening instrument used in conjunction with other instruments for early admission into classes and for gifted student programs; and 4) to investigate the logical reasoning of students with learning disabilities (Arlin, 1984). Arlin (1984) quoted Inhelder and Piaget's definition of the eight formal operational schemata as "the concepts which the subject potentially can organize from the beginning of the formal level when faced with certain kinds of data, but which are not manifest outside these conditions..." (p. 2).

An individual's formal reasoning development was a series of cognitive stages: concrete, high concrete, transitional, low formal, and high formal (Strahan & O'Sullivan, 1990). Two different sets of scores were determined by the ATFR: 1) an

individual's overall cognitive level (ranging from concrete to high formal) and 2) an individual's eight scores for each of the eight formal schemes subtests (volume, probability, correlations, combinations, proportions, momentum, mechanical equilibrium, and frames of reference) (Arlin, 1984; Santmire, 1985). Arlin (1984) indicated that an individual's overall cognitive level was not an indication of his or her success or failure with certain subject material; instead, it represented the individual's current type of thinking (Arlin, 1984). In contrast, the scores for the eight formal schemes subtests represented the student's style of thinking (Arlin, 1984). Arlin (1984) indicated that a wide variety of applications existed for ATFR and that it can be used by instructors/trainers for training/instructional planning.

Construct Validity and Reliability Concerns

The ATFR has been criticized for validity and reliability construct problems (Santmire, 1985). Specifically, the overall cognitive levels were criticized for psychometric reasons because Arlin did not outline a theoretical or empirical basis for the five levels (Santmire, 1985). In addition, the eight formal schemes of reasoning failed to satisfy internal consistency requirements (Santmire, 1985). However, research recommended the utilization of the ATFR only for determining an individual's overall cognitive level of reasoning development because this portion of the construct was reasonably robust (Santmire, 1985). Based on the

recommendations outlined in the research literature, only the scores obtained for the overall cognitive levels were utilized in this thesis.

Appendix F: Computer Technology Questionnaire

Computer Survey

Dear Participant,

This survey will take about 10-15 minutes to complete.

It is a survey about microcomputers and this class. To guarantee absolute confidentiality, this questionnaire will be returned directly to Professor Urs E. Gattiker. Your instructor will not see the individual responses. The report to be prepared will only include aggregate results, making it impossible to identify you personally.

The following questions are all concerned with computers. They are intended to measure how you feel about computers and about yourself. The survey is not a test, so there are no right or wrong answers. We are interested in your feelings and perceptions, and we ask that you answer the questions as honestly as possible. It's an opportunity to describe your experiences, and we hope you'll find it interesting. Some of the questions may not seem exactly appropriate to your situation--in that case, just give us your best guess.

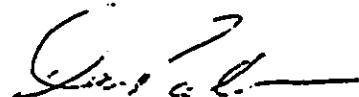
Your help and cooperation in this matter are greatly appreciated. Your responses will provide a better understanding of people and computers.

If you wish a copy of the final results of this study, please complete, detach and turn in the last page of this questionnaire with your home address.

Thank you very much!



Urs E. Gattiker, Ph.D.
Assistant Professor



Dan Paulson
Assistant Professor

Computer # _____
(For statistical purposes only).

The following questions deal with some issues of what you think about computers. Please answer each as it pertains to your situation.

- 1 disagree completely
- 2
- 3
- 4
- 5 agree completely

I believe that working with computers

makes work/studying more interesting	1	2	3	4	5
does cause back pain	1	2	3	4	5
does cause headaches due to eyestrain	1	2	3	4	5
means that some other people may be out of work because of increased efficiency/productivity	1	2	3	4	5
requires that I instruct the machine precisely in order to get tasks done accurately	1	2	3	4	5
means an intelligent human being interacting with a dumb machine	1	2	3	4	5
makes one's task more interesting	1	2	3	4	5
is very difficult	1	2	3	4	5
is stressful	1	2	3	4	5
is very complicated	1	2	3	4	5
requires a lot of mathematical skills	1	2	3	4	5
can be done only if one knows a programming language such as Basic	1	2	3	4	5
helps the company to be more productive	1	2	3	4	5
makes a person more productive at his/her job	1	2	3	4	5
requires technical ability	1	2	3	4	5
is only advisable for people with a lot of patience	1	2	3	4	5
is for young people only	1	2	3	4	5

The following questions deal with some issues of how much time you will spend working for this class. Please answer each as it pertains to your situation.

- 1 disagree completely
- 2
- 3
- 4
- 5 agree completely

I believe that I will

spend more than 2 hours a week in the LAB to practice	1	2	3	4	5
use every chance I get to practice my new skills	1	2	3	4	5
go through the LAB material again step by step on my own time after the LAB lecture	1	2	3	4	5
try to come to every LAB session	1	2	3	4	5
spend less than 2 hours a week to study for the CLASS section	1	2	3	4	5
do every LAB assignment as thoroughly as possible	1	2	3	4	5
will apply the new skills immediately to work for other classes	1	2	3	4	5
do every LAB assignment as thoroughly as possible	1	2	3	4	5
will spend less than 2 hours a week in the LAB to practice LAB related material	1	2	3	4	5
study for MA 3060 with classmates if possible	1	2	3	4	5
do some of my LAB assignments with classmates	1	2	3	4	5
spend more than 2 hours a week to study for the CLASS section	1	2	3	4	5
do all of my LAB assignments on my own	1	2	3	4	5
spend more time working for MA 3060 than I do for other classes	1	2	3	4	5
do none of my LAB assignments with classmates	1	2	3	4	5
spend more time for assignments for this class than I think will be necessary	1	2	3	4	5
will come into the LAB at least three times a week outside the classtime	1	2	3	4	5

The following questions deal with some issues of how you think the computer may help your work progress and career. Please answer each as it pertains to your situation.

- 1 disagree completely
2
3
4
5 agree completely

I believe that knowing how to use a microcomputer effectively

will help me to reach my career goals	1	2	3	4	5
is an ability which I value highly	1	2	3	4	5
is a necessity for today's graduating student	1	2	3	4	5
will help me acquire other new skills	1	2	3	4	5
will facilitate my future studies	1	2	3	4	5
will be necessary to obtain a good job after graduation	1	2	3	4	5
will facilitate my career progress	1	2	3	4	5
will improve my capability of solving business related problems	1	2	3	4	5
is required to keep pace with changing times	1	2	3	4	5
will help me to use it for private/personal tasks (tax return, investment planning)	1	2	3	4	5
will enable me to obtain information from national databanks (computerized libraries), e.g., in law, accounting, economics, etc.	1	2	3	4	5
will allow me to do more interesting work	1	2	3	4	5
is an easy way to get the "chores" (writing papers/reports) done faster	1	2	3	4	5
is part of a "well-rounded" management education	1	2	3	4	5
will help me with other courses in The School of Management	1	2	3	4	5
is necessary for other classes	1	2	3	4	5

The following questions deal with some issues of how you think you will use the computer outside the class. Please answer each question as it pertains to your situation.

- 1 disagree completely
- 2
- 3
- 4
- 5 agree completely

I intend to

use the microcomputer to prepare graphical presentations for other classes/work	1	2	3	4	5
use the microcomputer outside my class	1	2	3	4	5
buy some computer games for the microcomputer	1	2	3	4	5
explore the possibilities of a microcomputer on my own	1	2	3	4	5
use the microcomputer to write computer programs	1	2	3	4	5
play games with the microcomputer	1	2	3	4	5
buy a microcomputer (either on my own or with parents or other family members) within two years	1	2	3	4	5
use the microcomputer for my personal budgeting	1	2	3	4	5
use the microcomputer for some of my private chores	1	2	3	4	5
use the microcomputer to do my private correspondence	1	2	3	4	5
use the microcomputer to perform numerical analyses/calculations for other classes/work	1	2	3	4	5
find some computer games for the microcomputer so I can have some fun	1	2	3	4	5
use a word-processor to write all my assignments for other classes/work	1	2	3	4	5
use the microcomputer to maintain a personal address list	1	2	3	4	5

The following questions deal with some issues of how much general knowledge you might have about computers. Please answer each question as it pertains to your situation. Remember, there are no right or wrong answers in this survey.

- 1 disagree completely
2
3
4
5 agree completely

I

know the programming language COBOL so well that I can write a simple program without difficulty	1	2	3	4	5
could go to the university's main-frame computer and write a paper on its word-processing program right now without difficulty	1	2	3	4	5
have used a main-frame computer before (e.g., community college, at work)	1	2	3	4	5
believe myself to be a computer-literate	1	2	3	4	5
have some knowledge about computers	1	2	3	4	5
have used microcomputers before	1	2	3	4	5
have a microcomputer at home	1	2	3	4	5
play games on microcomputers frequently	1	2	3	4	5
have used a word-processing system before	1	2	3	4	5
know the programming language BASIC so well that I can write a program without difficulty	1	2	3	4	5
have <u>typed</u> most of my class-papers in the past	1	2	3	4	5
know the programming language Pascal so well that I can write a program without difficulty	1	2	3	4	5
have used spread sheet programs (e.g., Lotus 1-2-3, Visical) before	1	2	3	4	5
had the opportunity to work with a microcomputer during high school	1	2	3	4	5
play coin-operated arcade games frequently	1	2	3	4	5
can type at least 20 words per minute without making mistakes	1	2	3	4	5

know the programming language FORTRAN so well that I can write a simple program without difficulty	1	2	3	4	5		
have used such statistical program-packages like SPSS, BMDP, SCSS frequently			1	2	3	4	5
had to do some class-assignments for other university courses on a main-frame computer	1	2	3	4	5		
type <u>all</u> my class-papers myself	1	2	3	4	5		
have used the university's main-frame computer's word-processing package	1	2	3	4	5		
have taken a typing course (e.g., in high school, community college)	1	2	3	4	5		

The following questions deal with the issue of what you are expecting out of this course in regard to your performance. Please complete each statement as it pertains to your situation.

You expect to do better in this course than (please circle the number for the appropriate answer):

1. 20%
2. 40%
3. 60%
4. 80% of your fellow students

You expect to obtain an:

1. F
2. D
3. C
4. B
5. A as a final grade in this course

You expect to obtain an:

1. F
2. D
3. C
4. B
5. A as a final grade in the LAB-section of this course

You expect to obtain an:

1. F
2. D
3. C
4. B
5. A as a final grade in the CLASS-section of this course

SOCIAL BACKGROUND

Are you: Male _____
 Female _____

Are you: married _____
 never married _____
 previously married _____

Do you have children? # _____

How old are you? # _____ years

Are you employed? full-time _____
 part-time _____
 not at all _____

If you work, how many hours per week? # _____ hours

For how many classes have you registered this semester? # _____ classes

How many hours do you usually spend for an average class preparing and doing assignments outside the class room during one week? # _____ hours

What is your highest level of education completed (please circle)?

1. Completion of elementary school or less
2. Some high school
3. High school or equivalent (matriculation)
4. College diploma
5. First university degree
6. Some graduate or professional education after university degree
7. Graduate degree

How long ago did you finish your most recent credit course (e.g., high school, community college, university)? Year # _____ Months # _____

Are you pursuing a B.Mgt.? _____ Mgt. Certificate? _____ Other? _____

What is the current year of your program? # _____

What is your student ID#? _____

What is your Name? (Please use block-letters.)

Last _____ First _____

Please return this study to the person who gave it to you, or mail it to

Urs E. Gattiker, Ph.D.
School of Management
The University of Lethbridge
Lethbridge, Alberta
Canada T1K 3M4

If you would like a copy of the results, please detach this sheet and send your name and address:

Name

Address

Thank you for your help!

August 29, 1994

THESIS