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A Correlational Study of The Relationship Between Selected Adult Learning Styles and Achievement in a Computer Based Course

By

Lionel Bernard Shewchuk 

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Education

in

Instructional Technology

Department of Educational Psychology

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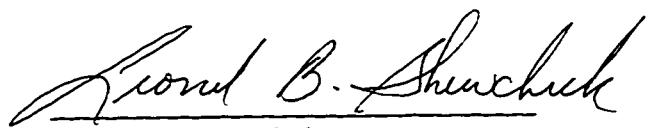

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ABSTRACT

The purpose of this study was to determine if there is a relationship between specific adult learner preferences and achievement in a computer managed mathematics course in a post-secondary institution. The Dunn, Dunn, and Price Productivity and Environmental Preference Survey (1993) and an Attitude survey were administered to 55 students. Four hypotheses were established to determine if a correlation existed between achievement in a mathematics course using a computer managed learning system and the learning preferences of formal or informal environment design, preference to working with peers or alone, preference for auditory or visual formats, or preference for time of day learning occurs. Findings showed that although 67% of the students had a positive attitude toward computer managed learning, correlational analysis did not reveal any significant relations between achievement and the four learner preferences selected.

ACKNOWLEDGEMENTS

I would like to express my sincerest gratitude to the professors on my committee. I especially would like to thank Dr. Michael Szabo for his patience, support, and encouragement during this process. I would also like to thank my wife Aileen, and my sons Matthew and Stephen for the time and support they gave me along the way.

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CHAPTER I

Introduction

The typical person will be engaged in learning throughout their lifetime. Each learning experience aids in the development of philosophies, attitudes, and the meta-cognitive schemata which form and solidify into different and unique learning characteristics. These long term experience-based characteristics are united with biological and personal characteristics to form the basis of an adult's mode of processing information. This individual method of processing is referred to as a learning style and is deemed by many to be a vital part of the input by the learner to the learning experience (Dunn (1990), Hannafin (1991), Keefe (1990), and Rowland & Stuessy (1988)).

Summary of Literature

Although thought to be somewhat radical in her thinking at the time, Stillman (1928) recognized the part student characteristics played in the learning process, and attempted to design learning experiences around her students' learning styles. Gagne (1970, p.14) recognizes this when he writes, "The site of learning is not in a group, nor is it in a relationship between instructor and student. The site of learning is the individual's central nervous system. For this fundamental and unarguable reason, learning is [sic] individual."

If teaching adults through their individual learning style is the best way to design a learning process, then it is reasonable to assume that a higher level of learning occurs when an adult is taught through their learning style preferences. DeJoy and Mills (1989) determined that achievement will go up and frustration will come down if students are taught through their personal preferences. Although some researchers have reported significant results with learning style research, Keefe (1990) identifies the need for further research before embracing the correlation between learning styles and instructional design.

If the learning process is designed to accommodate a student's learning preferences, then one might expect a learning process sensitive to learning preferences would employ the tools necessary to integrate the teaching with the individual's personal learning style. Many educational learning structures are designed around a single method of information transfer. Achievement is based on how well a student responds, comprehends, and retains information from this style of presentation. This style may be effective for some of the learners, but due to varied human experiences, it will not be suitable for all students. Although the learning environment is designed to meet the needs of the greatest number of individuals, it is evident that learning really must take place in the mind of the learner (Gagne, 1970).

Learning style considerations may become meaningful when an adult population is involved. When adults engage in the learning process, they have competencies, experiences, learning preferences, and mental barriers which have become solidified. It may be possible for adults to obtain a higher level of achievement in institutions if learning style preferences are considered when designing courses; however, researchers such as Tobias (1989) have reported that regardless of subject matter, student macroprocesses appear to be unrelated to effectiveness, prior knowledge, and content differences.

One of the more useful tools teachers have today is the computer. A well designed computer program should be able to deliver a learning experience for an individual student based on the characteristics which make up the students' personal learning style (Ridling & Buckle, 1989).

Significance of the Study

This study explored selected adult learning style characteristics and their relationship to achievement in a computer managed mathematics course. Some of the learning preference variables such as motivation, intake, and responsibility are intrinsic to the student and are not easily manipulated by a computer controlled system. The learning style preferences this study addressed were:

i) formal or informal learning settings

ii) working with peers or working alone

iii) preference to learn by an auditory or a visual presentation mode

iv) preferred time of day for learning.

If a correlation exists between these learning style preferences and academic achievement, then a student's program of studies may be adapted to incorporate these personal learning preferences which may enhance academic performance in a given course.

Purpose of the Study

The purpose of this study was to determine if there is a correlation between specific learning style preferences and achievement in a mathematics course which uses computer managed instruction in a post-secondary institution. If a correlation exists, then greater attention should be given to incorporating these learning style preferences into the learning process.

Conclusions and Questions from the Literature

Many researchers (Dunn & Bruno (1985), Rowland & Stuessy (1988), Sharma (1987)) believe that it is not enough to provide learning experiences without consideration to the learning style of the student. If one of the goals of education is to have all students master the information presented, then it is possible that this information should be presented in a way which most closely matches each individual's way of learning information. If an understanding of

the common preferences of people who have had an enjoyable experience in a computer setting is found, then it will be possible to design the computer learning environment with not only sound pedagogical practices, but with processes which take the students' own method of information processing into consideration.

Hypotheses

Hypothesis #1(a) For adult students, there will be a statistically significant relationship between achievement in a computer managed mathematics course and a preference for formal versus informal learning environments.

Hypothesis #1(b) The relationship between adult student academic achievement in a computer managed mathematics course and preference for formal or informal learning will be stronger for students with a positive attitude toward computer managed courses than for students with a negative attitude toward computer managed courses.

Hypothesis #2(a) For adult students, there will be a statistically significant relationship between academic achievement in a computer managed mathematics course and a preference for working with peers versus working alone.

Hypothesis #2(b) The relationship between adult student academic achievement in a computer managed mathematics course and preference for working with peers or working alone will be

stronger for students with a positive attitude toward computer managed courses than for students with a negative attitude toward computer managed courses..

Hypothesis #3(a) For adult students, there will be a statistically significant relationship between academic achievement in a computer managed mathematics course and a preference for auditory verses visual presentation formats.

Hypothesis #3(b) The relationship between adult student academic achievement in a computer managed mathematics course and preference for auditory or visual presentation formats will be stronger for students with a positive attitude toward computer managed courses than for students with a negative attitude toward computer managed courses.

Hypothesis #4(a) For adult students, there will be a statistically significant relationship between academic achievement in a computer managed mathematics course and a preference for the time of day learning occurs.

Hypothesis #4(b) The relationship between adult student academic achievement in a computer managed mathematics course and preference for the time of day learning occurs will be stronger for students with a positive attitude toward computer managed courses than for students with a negative attitude toward computer managed courses.

Importance of the Study

There is a continuing and increasing trend for adult education due to retraining for career opportunities and continued lifelong learning. The goal of this study is to determine if there is a relationship between an adult's learning style preferences and achievement in computer courses. If significant relationships exist, then courses could be developed which include methods and paradigms which yield improved academic results in computer managed courses. Therefore, it becomes more important to design the learning experience around a more flexible and individually targeted learning environment.

Effectively developed computerized instructional systems have the advantage over in-class situations in that they are impervious to time and in many cases, facility constraints. Geisert (Geisert & Dunn & Sinatra, 1990, p.300) writes, "One of the advantages computers have over teachers is that they are functional morning, noon, and night, and thus, are responsive to chronobiological highs and lows." A one-on-one learning situation between a teacher and a student results in significantly better learning (Bloom, 1976); however, this is not cost effective, nor is it logistically feasible. A computerized instructional system may provide the cost effective connection between learning style and information processing in an adult learning environment.

Understanding how an individual prefers to process information and designing the learning experience around the student's personal learning preferences may provide a learning experience which is more fulfilling and less stressful. A well designed computer managed instructional system may have the ability to adapt to learner preferences.

This study will provide insight into learning style preferences which would be considered when developing computer managed learning programs. The results of this study provide a basis for continued research into the relationship between individual learning styles and achievement.

Limitations of the Study

Learning Style Inventory The learning experience encompasses many factors. The Dunn, Dunn, and Price Productivity and Environmental Preference Survey (1993) identifies 20 preferences related to the learning style of the individual. Although other preferences relating to individual skills, capabilities, and pre-dispositions also affect the learning experience, the 4 preferences chosen are environmental preferences which are readily adaptable in a computer managed learning environment.

Student's Experience The student's computer learning experience in this study was provided in the normal course of

instruction and therefore understood as simply an experience of learning using a computer.

Student's Motivation The students were post-secondary adults who are generally motivated to learn. Since all aspects of an adult population were not included in the sample, the results cannot be directly applied to all adults without further study.

Previous Knowledge Some of the students coming to the institution may have a strong mathematics background which would account for higher than expected achievement in a computer managed course.

Mathematics Course Attitude The data was collected after the course had been completed. A positive or negative attitude by each student toward computer managed learning may have been biased by their respective final grades in the course.

Glossary of Terms

Computer Based Instruction These programs are designed to be focused on the instruction. The computer provides treatment based on different methodologies and feedback for the student on their responses to these treatments (Alessi & Trollip, 1985).

Computer Managed Instruction These are computer-delivered assessment programs specifically designed to aid the teacher and student in the diagnostic and prescriptive activities of the teaching process (Alessi & Trollip, 1985).

Correlation Correlational research involves collecting data in order to determine whether, and to what degree a relationship exists between two or more quantifiable variables (Gay, 1992).

Learning Strategy Learning strategies are considered to be any behaviors or thoughts that facilitate encoding in such a way that knowledge integration and retrieval are enhanced (Dunn, 1988).

Learning Style Learning Style is a biological and developmental set of personal characteristics that make the same teaching effective for some and ineffective for others (Dunn & Beadry & Klavas, 1989)

Learning Style Inventory A Learning Style Inventory is a question bank with a series of well designed questions which upon analysis, provide a cognitive/learning profile of the learner (Keefe & Monk, 1990).

Learner Preferences Learner Preferences refer to the individual preferences identified by the Learning Style Inventory (Dunn, 1990). The preference of design is based on how the person reacts to formal and informal settings. The classroom would be defined as a formal setting. The peers preference is based on the student's need for peer involvement in the learning process. The preference of auditory refers to a preference where the student must hear the information to assimilate it. The preference of visual refers to a preference where the student assimilates the information by the

use of videos, filmstrips, transparencies, computer monitors, diagrams, books, and generally resources which require seeing the information. The preference of learning is based on information being presented at the time the student is ready to learn.

CHAPTER II

Literature Review

There is an ever increasing pool of educational research which analyses the achievement of learners within controlled environments. This research consistently reveals individual differences within the subject groups. If an individualized learning environment is conducive to higher achievement, then equipment and instructional strategies which enable the teacher to customize the environment to meet individual student needs certainly warrant further investigation.

Learning Style and Achievement

Historically, since the turn of the century in North America, education has been a process where information is presented to a group of students, and the students were evaluated on the basis of how much of the information could be articulated on an examination. This educational paradigm is effective in stratifying a student population, but it does not provide an optimum learning environment for the student. Employing teaching strategies which focus on the strengths of the student may provide the key to improved achievement. Dunn (Dunn & Beadry & Klavas, 1989, p.56) writes, "They also disregard Cafferty's (1980) findings that the closer the match between each student's and the teachers' styles, the higher the grade point average; and the reverse."

A basic premise of research into learning styles is that the learner has a preferential mode of learning which is unique to his/her learning process. These characteristics are collectively referred to as their learning style and contribute to their overall information processing function (Dunn, 1983). Keefe (1990, p.44) states, "Learning style has perceptual, cognitive, study and instructional elements." Keefe (1990, p.44) further states that, "Style characteristics derive from genetic coding, personality, development, motivation, and cultural and environmental influences. These are relatively persistent qualities in the behavior of individual learners".

Many high achieving students develop a routine for internalizing information which circumnavigates the teaching strategies involved. McGowan and Clark (1985, p.15) state, "Higher ability students, on the other hand, are often found to ignore behaviorist instructional methods in favor of their own idiosyncratic learning strategies, or to profit more from "less" instruction." Lower ability students may not be able to impose an intrinsic learning method over the fixed teaching strategy. Essentially, a very good learning system can fail with a segment of the student population due to a disregard for the learning style of the student. Dunn (Dunn, Beadry & Klavas, 1989, p.51) expands this by stating, "Learning style is a biologically and developmentally imposed set of personal

characteristics that make the same teaching method effective for some and ineffective for others".

Learning Style Theories

The study of human information processing has taken different paths for different theorists. Dunn and DeBello (1981) have identified some of the prominent theorists and their approaches. In terms of individual research methodologies, Dunn and DeBello (1981, p.373) write:

> Canfield and Lafferty discuss conditions, content, modes, and expectations; the Dunns itemize stimuli and elements; Gregorc emphasizes distinctive behaviors and duality's; Hunt refers to conceptual level; Kolb specifies hereditary equipment, past experience, and the environment; Schmeck contrasts deep and shallow information processing.

Moore (1991), identifies the problem that it is not clear among the theorists whether this is an instructional or organizational decision.

Although some authors believe that learning styles are inherited, conclusive evidence has not been found to demonstrate that parents or siblings possess the same learning style. Some authors (Ramirez and Castaneda, 1974) feel that learning style is not fixed and it may even be advantageous to teach children through their weakest characteristic in order to strengthen this characteristic.

Adult Learning Characteristics

In designing the learning environment for adults, greater attention must be paid to the competencies and experiences already inherent in the adult (Boone, 1985) . An adult's learning process is molded by life experiences and previous information. Information must now be integrated into the web of memory mapping and not simply forced into the neural network. Although a younger student may be able to adapt and mold into a prescribed system, adults have greater difficulty adapting to an instructional system which does not consider their learning styles. DeJoy and Mills (1989) have determined that the instructional strategies used in the adult educational process are the key to adults having a positive learning experience. In programs designed for adults, DeJoy and Mills (1989, p.40) state:

> Adult learners regularly want to "pick and choose" the specific materials they needed to learn or review from the larger content of the material; once the selection was made, learners continued to impose their own learning "styles" on the material and required opportunities to back-up, adjust presentation speed and sequence, and skip around the material as their interests dictated. When the instructional technology did not permit these learning strategies, adult learners became frustrated with

the interaction, and the quality of the experience was diminished.

If DeJoy and Mills (1989) observations are correct, it can be argued that adults will have an enhanced learning experience with higher academic success if they have control of their learning process. Even if they are unaware of the basis for their decisions, in effect they are attempting to tailor the learning environment to their personal learning style.

In designing learning systems for adults, Szabo (1990) has identified several factors which appear to impact satisfaction and achievement. Some of the areas identified are prerequisite knowledge, learner control, competency based, mastery, guidance, self-pacing, feedback, flexible study time, question and practice items, training objectives, graphics, and individual learner differences. Ridling and Buckle (1989) found that if the learning style of the learner did not match the presentation format, there was a marked difference in post-test scores. Ridling and Buckle (1989, p.393) conclude their study by stating, "To be cost-effective, training must be capable of adapting to the learning style of the individual trainee."

Learning Style Integration

Earlier researchers have identified the need for learning style analysis in the design process. Goodman (1978) felt that one of the

major factors to come out of the integration of the computer into the educational system was the ability to design the learning experience around the student's learning styles. Later studies (Keefe, 1990) have determined that learning style analysis and research will be a major factor in continued educational growth.

In studies done by Dunn & Beadry & Klavas (1989), Ridling & Buckle (1989), Carrier (1981), and Cosky (1980), the outcomes have been consistent. Students who are taught by methods which are consistent with their personal learning preferences show greater achievement than if taught in a manner which does not match their learning preferences.

In research on learning style preferences as influencing variables on achievement, Sharma (1987) concluded that if considerations are made in the design process, students may be placed in learning environments which are more suited to their learning style. In mass educational systems where students may be routed into different styles of learning systems, a learning style inventory may be issued to each student at the time of entrance application. The students could then be placed in learning situations which more closely match their learning style. This process would not only provide a more enjoyable learning experience for the student, but also increase the probability of academic success.

Coventry (1989) tested a group of students on learning the UNIX computer operating system. The study showed that preferential modality does have an effect on how a person perceives and engages in a learning situation. He determined that when a student is allowed to move through a learning situation in a manner consistent with his/her learning preferences, the learning time is shortened and greater learning is achieved.

Hannafin (1991) determined that if the learning situation was determined by the learner, greater depth processing would occur. In his study, the primary factor in the development of this learning situation was the fact that the learner chose the learning style perceived to be the best for them.

Many subjects exhibited reduced performance when performing a task which was uncomfortable or difficult (Aster & Clark, 1985). In many students, this transfers into reduced achievement due to a negative attitude toward the learning experience. In studies with children, Dunn and Bruno (1985) determined that students who are taught using their personal learning styles display an improved attitude toward the learning process. Their study showed that student achievement increases with the use of an appropriate learning style.

Learning Style and Instructional Technology

This study examines the relationship between a computer managed learning environment and the academic and attitudinal results of participants learning within this environment. The participants in this study have had their computer learning experience in a computer managed mathematics course.

Although computer technology has provided educators with a new and powerful tool, it is not the technology alone which will provide a learning condition. Salomon, Perkins and Globerson (1991, p.3) write, "But this means that it is not technology alone affecting minds but the whole "cloud of correlated variables" - technology, activity, goal, setting, teacher's role, culture - exerting the combined effect".

When the technology is used to provide a learning environment, it must still be implemented with solid learning theory practices. Tennyson and Rasch (1988, p.372) write, "As Gagne (1985) has often written, the creative process can be improved by instructional methods that allow the students opportunity to create knowledge within the context of a given domain". Tennyson and Rasch (1988) determined that learning is improved when the information is presented within a specific domain. The linking of personal learning preferences to the process of information processing appears to be a consistent thread through much of the research. Coskey (1980) also

identifies the need for implementation of cognitive style factors when designing individualized computer based instruction.

Developing learning strategies which are unique to every student's learning style is a monumental assignment for an individual teacher. The use of a computer system to provide the time consuming task of monitoring and providing adaptive feedback makes the task feasible for the educator. Tobias (1989, p.108) writes, "Computers may well be an ideal vehicle for teaching more effective cognitive processing of instruction. Such equipment can easily individualize instruction, monitor students' processing continuously, intervene with different types of assistance when necessary, and retain data on all these operations." The flexibility of the computer to provide an environment which is tailored to the student's learning style may well provide the catalyst necessary for higher achievement.

Summary

The research showed that some educators accept the premise that students possess and bring a personal set of learning preferences to a learning environment (Dunn, (1990), Keefe, (1990), Carrier, (1981)). The nature and structure of these preferences, and how they interact with learning environments is still a question for debate.

Researchers such as Dunn (1988), DeJoy and Mills (1989), Ridling and Buckle (1989), and McGowan and Clark (1985) have determined that teaching through personal learning style preferences

may have a positive impact on information processing during the students' learning experience. Other researchers such as Ramirez and Castenada (1974) report that it may be more advantageous not to teach students through their personal preferences in order to strengthen other areas of the students' learning environment.

When students were taught through their learner preferences, outcomes such as improved attitude (Aster & Clark, 1985), academic improvement (Dunn & Bruno, 1985), and improved student confidence (Dunn, 1990) have been reported by researchers. The research supports a relationship between the existence of learning style preferences and improved learning outcomes when students are allowed to learn in an environment which is accepting of those preferences.

CHAPTER III

Research Methodology

Design of Study

The purpose of this correlational study was to determine if there is a relationship between selected adult learning style preferences and achievement in a computer managed mathematics course. This study was designed as a correlational study to study the relationship between the learning style preferences judged by the researcher to be most applicable to computerized instruction and student achievement in the computer managed mathematics courses.

Hypotheses

H1(a): For adult students, there will be a statistically significant relationship between achievement in a computer managed mathematics course and a preference for formal versus informal learning environments.

H1(b): The relationship between adult student academic achievement in a computer managed mathematics course and preference for formal or informal learning will be stronger for students with a positive attitude toward computer managed courses than for students with a negative attitude toward computer managed courses.

H2(a): There will be a statistically significant relationship between achievement in a computer managed mathematics course and a preference for working with peers versus working alone.

H2(b): The relationship between academic achievement in a computer managed mathematics course and preference for working with peers or working alone will be stronger for students with a positive attitude toward a computer managed course than for students with a negative attitude toward computer managed courses.

H3(a): For adult students; there will be a statistically significant relationship between achievement in a computer managed mathematics course and a preference for auditory versus visual presentation formats.

H3(b): The relationship between achievement in a computer managed mathematics course and preference for auditory or visual presentation formats will be stronger for students with a positive attitude toward computer managed courses than for students with a negative attitude toward computer managed courses.

H4(a): There will be a statistically significant relationship between achievement in a computer managed mathematics course and a preference for the time of day learning occurs.

H4(b): The relationship between achievement in a computer managed mathematics course and preference for the time of day learning occurs will be stronger for students with a positive attitude

toward computer managed courses than for students with a negative attitude toward computer managed courses.

Sample

The sample for this study was drawn from an adult student population in a post-secondary technical institute in Western Canada. The institute offers technology programs which encompasses two years of study. Each year is divided into two semesters. The volunteer subjects were in their second semester of the first year of a technology program. Each volunteer had taken a computer managed mathematics course in the first semester, 1996. Only students who had a computer managed mathematics course were invited to participate in the study as an initial screening process. This qualification was also confirmed in the Attitude Survey and the computer managed course was listed (Appendix A). The mathematics course provided the basis for the students' computer learning experience.

At the beginning of this study, the institution agreed to provide the researcher a minimum of 300 students as test subjects. Upon conducting the data collection process, 55 students agreed to participate in the study.

Data Collection Environment

The computer managed mathematics course is a fixed entry and fixed exit course where the students are not in a regular classroom

setting. In this learning environment the students use the computer to take tests as a form of drill and practice. However, the computer managed learning system is not capable of providing instruction remotely, and the students must attend lectures to receive information and feedback on their questions. The data collection forms were filled out when the students were brought together to write supervised exams.

The computer managed learning system used was strictly a text based system which provided the student with a list of errors upon completion of a test. The student is allowed to retake a test to either pass or upgrade their mark. The computer managed learning system does not provide information in other forms such as graphics, animation, or audio.

Instruments

The instruments used in the data collection process were an Attitude Survey form (Appendix A) and a learning style preference inventory called the Dunn, Dunn, and Price Productivity Environmental Preference Survey (Dunn , Dunn & Price, 1993) purchased from Price Systems Inc. in Lawrence, Kansas. These two survey forms provided data for assessing the student attitude toward computer managed learning and the preferred learning characteristics for each student. The forms were issued to 55 students.

Productivity and environmental preference survey instrument. The PEPS form is a 100 question learning style inventory form called the Productivity Environmental Preference Survey designed by Dunn, Dunn, and Price which profiles individuals based upon 20 dichotomous elements of personal learning preference. In the opinion of the researcher, the four areas studied reflect the learning styles on which proper implementation of computer managed learning system design would have the most impact.

These elements of learner preference for this study were formal/informal learning environment design learner preference, working with peers or working alone learner preference, preference for information to be of an auditory or a visual nature, and time of day for optimal learning learner preference. Although the other 16 areas of the PEPS survey form provide information on the students' learning preferences, they were judged not to be directly related to computer learning conditions. The following definitions and reliability statistics are taken from the Productivity and Environmental Preference Survey Manual issued by Dunn, et al. (1993).

Design learner preference. The preference of design has a reliability coefficient of .74, and is based on how the person reacts to a placement in a formal structured setting, or an informal assignment based setting. The classroom would be defined as a formal setting.

A high result in this category is exemplified by a person who prefers a structured environment and must have all assignments and objectives clearly stated and defined. Time constraints, resources, and required tasks must not be left for interpretation. The person with a non-structured preference will require well defined objectives; however, the process, resources, and reporting functions must be open enough to provide latitude in the production of the final product.

Peers learner preference. The peers preference has a reliability coefficient of .84 and is based on the student's preference for peer involvement in the learning process. The person with a score less than 40 in this category will prefer to work alone on an assignment or project. People who prefer to work with peers will prefer to work in groups or teams.

Auditory learner preference. The preference of auditory refers to a preference where the student prefers to hear the information to assimilate it. This preference has a reliability coefficient of .78. The student who prefers to hear information learns best when the material is presented by lecture, audio-tape, videotape, and instructions are in oral form. The student who prefers to read should be allowed to read the information before proceeding with assignments or lectures.

Visual learner preference. The preference of visual refers to a preference where the student assimilates the information by the use of videos, filmstrips, transparencies, computer monitors, diagrams, books, and generally resources which require seeing the information. This preference has a reliability coefficient of .67.

The learner preferences of auditory and visual have been addressed under one hypothesis. Although they have individual survey results, they are related to information transfer mode preferences rather than environmental learning preferences. Many computerized learning environments are able to provide information on a continuum from sound to video. The data was analyzed as separate learner style preferences.

Time of day learner preference. One of the major contributions of computer managed learning to the learning environment is the preference of learning occurring at the time the student is ready to learn. The evening person has their strongest point in their time energy relationship in the evening. Scheduling of difficult tasks, learning processes, and assignment duties during this time would enhance the learning process. The morning person prefers to perform the same tasks in the morning. On-line computer courses may be a preferred choice for students who prefer to learn outside institutional operating hours. The preference of time of day has a reliability coefficient of .84.

Attitude Survey Instrument

The Likert style attitude survey, Student Opinion Toward Computer-Assisted Instruction (Appendix A), was comprised of 28 statements designed to elicit information on the student's attitude toward their experience with computer managed instruction. The survey form was designed to determine how students felt about the computer experience and not the subject material studied. The statements had a rating scale of 1 to 5 which went from strongly disagree (SD) to strongly agree (SA). The statements were worded in positive or negative formats to deter the student from selecting one response for all the statements on the form.

The test instrument had 14 items stated in a positive fashion and fourteen items stated in a negative fashion. The item scores were weighted and added to establish a total score which identified the respondent as having a positive or negative opinion toward computer managed instruction. The maximum score obtainable was 140, with the minimum score being 28. A positive or negative attitude placement is determined by a score above or below the mean score for the 55 subjects.

The instrument was tested for reliability. The administration of one test allowed for the use of the Cronbach Alpha split-half reliability test for internal consistency (Cronbach, 1990). The

survey form had a Cronbach coefficient alpha of .73 for internal consistency.

Achievement

Achievement was operationally defined as students' final grades in the mathematics course which was taught using the computer managed learning system. These were obtained from the Institution's Registrars Office along with grade point average as a general measure of ability. The institution uses a percentage system (0% to 100%) for reporting individual grades. Students scoring above the mean for the participants studied were placed in the high achievement group. As part of general data to be collected on the student, the survey asked the student's name, program of study, CML experience, age, and gender.

Data Collection

All of the research information was collected at the same time. The three items were:

a) a Consent Form,

b) an Attitude Survey Form, and

c) a PEPS Learning Style Inventory.

All of the participating students signed a Consent Form (Appendix B) before entering into the study, and were verbally informed that the information gathered would only be used for research purposes. They were advised that any information collected would not affect their

status in the institution, and that regardless of their reasons, they could withdraw from the study at any time. Data from one student was discarded due to the student not signing the Consent Form. All student records were identified and analyzed with the use of a random numbering system. All the information received referred back to a number assigned to the respective set of test results.

Data Analysis

The correlation analysis was done by the use of a Pearson r correlation formula.

For hypothesis 1(a), the researcher examined the correlation between computer managed course grades and the environment design learner preference scores. For hypothesis 1(b), a comparison was made between the correlation coefficients from the computer managed course grades and the design learner preference for students scoring above the median and below the median on the attitude score.

For hypothesis 2(a), the researcher examined the correlation between computer managed course grades and the peers learner preference scores. For hypothesis 2(b), a comparison was made between the correlation coefficients from the computer managed course grades and the peers learner preference for students scoring above the median and below the median on the attitude score.

Hypothesis 3(a) examined the correlation between computer managed course grades and both the audio and visual learner

preference scores. For hypothesis 3(b), a comparison was made between the correlation coefficients from the computer managed course grades and both the audio and visual learner preference for students scoring above the median and below the median on the attitude score.

Hypothesis 4(a) examined the correlation between computer managed course grades and the time of day learner preference scores. For hypothesis 4(b), a comparison was made between the correlation coefficients from the computer managed course grades and the time of day learner preference for students scoring above the median and below the median on the attitude score.

CHAPTER IV

Findings

The purpose of this study was to assess the relationship between selected adult learning styles and achievement in a computer managed mathematics course. In the first section of this chapter, correlation results of the PEPS learning style inventory and the students corresponding achievement scores are presented. The latter section of this section presents descriptive findings of the attitude survey results. Tables of data relevant to this section are provided.

Learning Style Survey Results

The Dunn, Dunn, and Price Productivity Environmental Preference Survey (1993) was administered to the 55 post-secondary students and the students were scored on their learning style preference on five of the preferences addressed in the survey. The five preferences studied were formal/informal design, working alone or with peers, auditory learner, visual learner, and preferred time of day for learning.

Information provided was based on a machine-scored learning style inventory. The instrument scored each student on a scale from 20 to 80 and placed the student in one of three categories which ranged from 20 to 39 for the low preference,

40 to 59 for a moderate preference, and 60 to 80 for a high preference. Summary data is provided in Table 1.

Table 1

Learning Style Preference Distribution for 55 Post-Secondary Students by Percentage and Frequency

Learning Style Preference	Percentage	Frequency
Informal / Formal		
Prefers Informal	14.5	8
Moderately prefers	72.7	40
Prefers Formal	12.7	7
Alone / Peers		
Prefers Alone	3.6	2
Moderately prefers	60.0	33
Prefers Peers	36.4	20
Auditory		
Does not prefer	7.3	4
Moderately prefers	76.4	42
Strongly prefers	16.4	9
Visual		
Does not prefer	9.1	5
Moderately prefers	89.1	49
Strongly prefers	1.8	1
Time of Day Preference		
Prefers Evening	21.8	12
Moderately prefers	76.4	42
Prefers Morning	1.8	1

Achievement and Learning Style Preference

Each preference was measured on a numerical continuum ranging from 20 to 80. Data pertinent to the percentage and frequency distribution is provided in Table 2.

Table 2

Percentage and Frequency Distribution of 55 Post-Secondary Students in the Learning Style Preference areas of Informal/Formal, Alone/Peers, Auditory, Visual, and Time of Day Learning Occurs.

Learning Style Preference	Percentage	Frequency
Informal / Formal		
High Achievement Prefer Formal	25.5	14
High Achievement Prefer Informal	18.2	10
Low Achievement Prefer Formal	29.1	16
Low Achievement Prefer Informal	27.3	15
Alone / Peers		
High Achievement Prefer Alone	16.4	9
High Achievement Prefer Peers	27.3	15
Low Achievement Prefer Alone	14.5	8
Low Achievement Prefer Peers	41.8	23
Auditory/Visual		
High Achievement Prefer Auditory	27.3	15
High Achievement Prefer Visual	16.4	9
Low Achievement Prefer Auditory	29.1	16
Low Achievement Prefer Visual	27.3	15
Time of Day		
High Achievement Prefer Evening	27.3	15
High Achievement Prefer Morning	16.4	9
Low Achievement Prefer Evening	41.8	23
Low Achievement Prefer Morning	14.5	8

Findings Related to Hypotheses

The first part of each hypothesis was tested by examining the correlation between student achievement in a computer managed mathematics course and student scores on each of the learning style preferences.

The data was analyzed using a Pearson r correlation coefficient calculation. The analysis was based on a sample where the df=54 with a p = 0.05. Based on a matrix (Gay, 1992, p.574), the critical value correlation coefficient for a 0.05 level of significance is r = 0.26. All of the Pearson r correlation coefficient values are displayed in Table 3.

Hypothesis 1(a) predicted that there would be a statistically significant relationship between achievement in a computer managed mathematics course and a preference for formal verses informal learning environments. The correlation coefficient for this condition was not significant (r = 0.02). Based on comparative analysis, the null hypothesis for H1(a) could not be rejected as it relates to student achievement and the PEPS inventory results.

In hypothesis 1(b), it was hypothesized that students who had a preference for formal or informal environments and displayed a positive attitude toward computer managed instruction would show a stronger relationship in academic performance than those students who had a negative attitude.

Table 3

Pearson r Correlation Coefficient for Achievement scores with Respect to the Learning Style Preferences of Informal/Formal, Alone/Peers, Auditory, Visual, and Time of Day Learning Occurs for Positive and Negative Attitudes toward Computer Managed Instruction

Condition	Pearson *r*
Hypothesis #1(a)	
Student Achievement Verses Formal/Informal	0.02
Hypothesis #1(b)	
Achievement verses Formal/Informal with Positive Attitudes	-0.01
Achievement verses Formal/Informal with Negative Attitudes	0.01
Hypothesis #2(a)	
Student. Achievement Verses Peers/Alone	-0.01
Hypothesis #2(b)	
Achievement verses Peers/Alone with Positive Attitudes	-0.02
Achievement verses Peers/Alone with Negative Attitudes	-0.01
Hypothesis #3(a)	
Student Achievement Verses Auditory	-0.01
Student Achievement Verses Visual	0.03
Hypothesis #3(b)	
Achievement verses Auditory with Positive Attitudes	-0.01
Achievement verses Auditory with Negative Attitudes	-0.01
Achievement verses Visual with Positive Attitudes	0.03
Achievement verses Visual with Negative Attitudes	0.03
Hypothesis #4(a)	
Student Achievement Verses Time of Day	0.09

(table continues)

Hypothesis #4(b)	
Achievement verses Time of Day with Positive Attitudes	0.05
Achievement verses Time of Day with Negative Attitudes	0.08

The students with a positive attitude with respect to achievement and a formal/informal learning preference displayed a correlation which was not statistically significant (r = -0.01). The analysis between achievement and a formal/informal learning preference with a negative attitude produced a correlation coefficient of r = 0.01.

In both conditions, the correlation coefficient is not high enough to warrant significance. Based on the PEPS form results, the participants achievement scores, and the Attitude Survey results, the null hypothesis for H1(b) could not be rejected.

Hypothesis 2(a) predicted that there would be a statistically significant relationship between achievement in a computer managed course and a preference for working with peers or working alone.

The Pearson r correlation coefficient for this condition was r = -0.01. Based on the correlation statistics, the null hypothesis for H2(a) could not be rejected on the basis of student achievement and the PEPS inventory results.

In hypothesis 2(b), it was hypothesized that the correlation coefficient for students with positive attitudes toward computer managed instruction would show a stronger relationship in academic performance and the preference of peers/alone, than students who displayed a negative attitude.

The positive attitude group with respect to achievement and a Peers/Alone preference scored a correlation coefficient of $r = -0.02$. The negative attitude group with respect to achievement and a Peers/Alone preference scored a correlation coefficient of $r = -0.01$.

Based on the correlation analysis of data generated by the PEPS learning preference form, the participants achievement scores, and the Attitude survey, the null hypothesis for H2(b) could not be rejected.

Hypothesis 3(a) predicted that there would be a statistically significant relationship between achievement and a preference for auditory verses visual presentation formats. The correlation coefficient for the auditory format with respect to achievement was $r = -0.01$. The correlation coefficient for the visual format was $r = 0.03$.

The correlation coefficients for the auditory/visual preferences were not statistically significant and therefore, based on the PEPS learning preference inventory and the

student's achievement scores, the null hypothesis for H3(a) could not be rejected.

Hypothesis 3(b) theorized that students who have a positive attitude toward computer managed instruction and a preference for auditory or visual learning environments, would show a stronger relationship in academic performance than those students who had a negative attitude.

The student with a positive attitude with respect to achievement and an auditory learning preference displayed a correlation which was not significantly different from zero. The student with a positive attitude with respect to achievement and an auditory learning preference displayed a correlation which was also not significant (r = -0.01). The positive attitude group with respect to achievement and a visual preference generated a correlation coefficient of r = 0.03. The negative attitude group with respect to achievement and a visual preference produced a correlation coefficient of r = 0.03.

Although the correlation analysis indicates a comparable coefficient between the positive and negative attitude students for both the auditory and visual preferences, the correlation coefficient was not significant. The null hypothesis for H3(b) was not rejected based on the PEPS form results, the

participant's achievement scores, and the Attitude Survey results.

Hypothesis 4(a) theorized that there would be a statistically significant relationship between achievement in a computer managed course and a preference for the time of day learning occurs.

The Pearson correlation coefficient for hypothesis 4(a) was $r = 0.03$. This correlation is not statistically significant and therefore based on the data generated from the PEPS form and the student achievement information, the null hypothesis for H4(a) could not be rejected.

Hypothesis 4(b) stated that students with a positive attitude toward computer managed instruction would have a stronger correlation coefficient toward time of day learning occurs and academic achievement than students with a negative attitude.

The positive attitude group had a correlation coefficient of $r = 0.05$. When a correlation was generated for the negative attitude students, the coefficient was $r = 0.08$.

The data generated for the time of day preference groups did not support the hypothesis and therefore based on the PEPS survey form, the participants' achievement scores, and the Attitude survey, the null hypothesis for H4(b) was not rejected.

Computer Assisted Instruction Attitude Results

On an overall basis, 67% of the 55 participants displayed a positive attitude toward computer managed instruction. The remaining 33% displayed a neutral or negative attitude toward learning by a computer managed learning system. The group of 42 males and 13 females had an average age of 25.7 years. Results and a summary of the attitude survey data may be found in Appendix C.

Summary

The findings indicate no significant relationship between achievement in a computer managed mathematics course and a preference for formal verses informal learning environments, for working with peers or working alone, for auditory or visual presentation formats, or for time of day learning occurs.

The difference in relationship between high and low attitude survey results with respect to achievement and learning styles was not significant.

CHAPTER V

Discussion

The purpose of this study was to assess the magnitude of the relationship between selected adult learning style preferences and subsequent achievement in a computer managed mathematics course.

Summary

In hypothesis 1(a), no relationship was found between achievement and the formal/informal learner preference and therefore the hypothesis was not supported. There was a large group of responses (73%) which fell in the mid-point of the preference scale. The lack of a range of scores may have been due to the fixed location of the students' computer managed learning experience. All of the interactions with the computer occurred in the institution's computer labs. The students were not exposed to a learning environment which allowed for a formal or informal setting preference and therefore did not see this preference as an issue. It is possible that the inability of the computer managed learning system to deliver instruction outside the classroom may have contributed to the lack of significant results.

Hypothesis 1(b) investigated how attitude affected the achievement and learner preference formal/informal. This research did not find a relationship between achievement and formal/informal design for either the positive or negative attitude students. If a student did not have a choice of learning environments, then possibly

a positive or negative attitude toward a formal or informal location is a non-issue in the framework of their computer learning experience.

In hypothesis 2(a), a statistically significant relationship was not detected between achievement and the learner preference peers/alone. A majority of the students (60%) did not have a preference for working with peers or working alone. The computer managed learning environment the students were using did not provide information back to the student if they had trouble with the material. In this learning environment the students must attend lectures to receive information and feedback on their questions. Under this computer managed learning environment, it would be very difficult for students to work alone. A computer learning environment which provides prescriptive feedback and is completely self-paced may provide a more significant correlation since the students could work alone.

The findings did not support hypothesis 2(b). Although 37% preferred to work with peers, attitude did not seem to be an issue in regards to achievement and the learning preference of peers/alone. It is possible that a student will achieve an acceptable grade regardless of their feelings for the learning environment. If the student must be in a group of peers to receive the information, then working alone would not be a realistic option.

In hypothesis 3(a), the findings did not support a statistically significant relationship between achievement and the learner preference of auditory or visual. In both information delivery modalities, the students did not show a definite preference. In their computer managed learning experience they interact in a visual mode to receive worksheets and tests; however, they must work in an auditory mode in a classroom setting to receive the information. It is possible that the student's experiences in a computer managed learning environment did not provide them with the background necessary to determine if they preferred an auditory or visual presentation format. The participants did not have a choice of media delivery modes and therefore it is not an issue with this group of students.

The findings for hypothesis 3(b) did not show a relationship and therefore did not support the hypothesis. The relationship between achievement and the media modalities of auditory or visual for positive and negative attitudes was identical for both modes. It is possible that since the students did not have a choice of media modalities, how they felt about an auditory or visual format was of little significance to them. Stronger relationships may be found if the students have a choice of presentation formats.

In hypothesis 4(a), a relationship did not exist between achievement and the time of day learner preference. Although 22%

preferred evening, 77% of the students did not have a high or low preference. A possible explanation for this result is the inability of the institution's computer managed learning system to deliver instruction during non-assigned hours. If the students did not have a choice of when their learning occurred in their computer learning experience, then the preference of time of day may be inconsequential.

In regards to hypothesis 4(b), a relationship was not found to support a correlation between attitude and achievement for the time of day preference. It is possible that attitude is not based on a time of day preference for students who do not have the choice of when the instruction is presented. If their computer learning experience does not allow for time of day preference conditions, then attitude may be a factor generated by other conditions in the computer managed learning environment.

Discussion

Although some researchers have reported relationships between learning style preferences and achievement (Moore, (1991), Dunn (1990)), others have not found a significant relationship (Clark (1984), Larsen (1992). In this study, no significant relationships were found between the selected adult preference and achievement.

The computer learning experience of the participants may have been a contributing factor to these results. The institution uses a

computer managed learning system which is essentially a drill and practice type of instructional strategy. This computer managed learning system uses conventional instruction and it is not designed to accommodate any specific learning styles or learning preferences. This system does not adapt to the individual learner preferences of the student. Influences such as other learning style factors, instructor intervention, course content difficulty, and the idiosyncrasies of the institution computer managed learning system may have contributed to the results of the correlational data analysis.

The findings provide evidence to show that students fall into different categories of learner preferences. Wholesale insertion of students into a computer managed program may not meet the needs of many of the students in the group. Much more research must be done to study placement of students in learning environments which match their learning styles and its effects on achievement and attitude.

Suggestions For Further Research

This researcher feels that greater significance may have been achieved if the test population were larger. A larger population would have provided a greater range of preference and achievement scores. Replicating this study with a larger population may provide correlational analysis which may be representative of a greater segment of the population.

An area for further study is the relationship between learning preferences and achievement where the learning environment is adaptive to the preferences of the learner. Since much of the research indicates a possible link between learner preferences and achievement, more research should be done where the student controls the learning environment.

Additional research is required to determine the necessary components required in the design of the computer managed learning system which will provide the adaptive learning environments for the individual learner. The research showed that students do have personal learning preferences. The challenge for learning system designers is to identify and design the learning system to address those learning preferences.

Recommendations

This study derived information which is applicable to educators, educational software designers, and institutional administrators.

The Attitude Survey indicated that students are comfortable with computer managed learning technology and are accepting of the technology in the classroom. This acceptance will allow for easier integration into the classroom. The findings also indicate that students do not prefer a computer managed learning system to be used as a stand alone learning system. At present, educators should

strive to integrate the computer into the learning environment as a learning tool. Since the research identified that students do have different learning preferences, identification and adaptation of the learning environment by the educator may provide a more fulfilling learning experience for the student.

An important element in the evolution of computer managed instructional systems is the role of the software designer. The computer managed instructional systems designer should design the computer learning environment to provide a prescriptive response to student answers. The Attitude Survey results indicated that students wish to have feedback to their responses built into the computer managed learning program.

This study indicated that a segment of the student population prefers to learn by a self-paced computer managed learning system. If administrations determined which students prefer to learn by a computerized learning environment, a distance delivery program of studies could be established which would reduce the pressure on institutional space.

In order to design learning environments utilizing the study learner preferences, several conditions should be part of the computer managed learning system. The system should be able to provide prescriptive feedback to student responses. The learners

should be able to receive feedback whether they are in a formal or informal learning environment.

Computer managed learning systems should be designed with full audio and high resolution graphics. The addition of audio and animated video would add a dimension to the lessons which would address the auditory and highly visual learners.

The preferences of peers/alone and time of day may be addressed by the institution providing more access time to the computer labs. These preferences may also be addressed by providing more access to the computer system by remote computer terminals. The student may work with other students at any time of the day or night using a remote computer.

Conclusion

Computers are becoming more entrenched into the processes of everyday life. As more students use computerized educational systems, research into the proper development of these computer learning systems is essential to the success of all students who will learn by these systems.

Although research is increasing in the area of learning style integration with instructional design, the links, if any, between a student's individual learning style and the corresponding design considerations in the computer managed learning system are still somewhat elusive. With additional research into learning style

characteristics, instructional design strategies may be designed and integrated into computer learning courses to meet these learning preferences.

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APPENDIX A

Student Opinion Toward Computer-Assisted Instruction

The information gathered from this survey form will be used for educational research. All the information will be kept in strictest confidence.

Student Name _____ ID# _____

Program of Study _____

Gender Male _____ Female _____ Age _____

Have you used the Campus America System ? YES _____ NO _____

What was the name of the course? Course Name _____

What was your final mark in the course? _____

Please Note: **This survey is based on how you felt about both working with, and working in, the computer learning system. It does not apply to any other learning environment.**

In the survey below, you will be asked for your opinion how you felt about your computer assisted learning experience. On the right side of questions are the letters SA, A, U, D, and SD. The opinion expressed by these letters is shown below. Please completely fill in the dot below the letter which most accurately reflects your opinion on the question. Please read each question carefully.

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

	SA	A	U	D	SD
1. I prefer to learn new concepts in a classroom setting with a group of people.	O	O	O	O	O
2. I like to have new information explained to me by the instructor before I really learn it	O	O	O	O	O

	SA	A	U	D	SD
3. I like to sit in a comfortable chair when I am working on a computer lesson.	O	O	O	O	O
4. I feel unattended and alone when working on the computer.	O	O	O	O	O
5. Operating the computer makes it too difficult to concentrate on the course material.	O	O	O	O	O
6. Nobody really cared whether I learned the course material or not.	O	O	O	O	O
7. I computer made me feel as if I had a private tutor.	O	O	O	O	O
8. As a result of having studied by this method, I am interested in taking more courses by the computer.	O	O	O	O	O
9. I learn the concepts much faster when I use computer assisted learning.	O	O	O	O	O
10. Learning new concepts in a formal classroom makes me tense.	O	O	O	O	O
11. I did not have anyone to talk to and felt frustrated by the learning experience.	O	O	O	O	O
12. I liked the ability to work in the evening and take as much time as needed to answer the questions.	O	O	O	O	O
13. Material which is otherwise interesting can be boring when presented by the computer.	O	O	O	O	O
14. In view of the amount learned, this method seems superior to classroom instruction for many courses.	O	O	O	O	O
15. I would prefer computer assisted instruction to traditional instruction.	O	O	O	O	O
16. Computer Assisted Instruction is just another step toward de-personalized instruction.	O	O	O	O	O

	SA	A	U	D	SD
17. I like the ability to use the computer in the early morning at home.	O	O	O	O	O
18. I was concerned that I might not be understanding the material.	O	O	O	O	O
19. I felt uncertain as to my performance in the programmed course relative to the performance of others.	O	O	O	O	O
20. I was not concerned when I missed a question because nobody was watching me.	O	O	O	O	O
21. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.	O	O	O	O	O
22. I did not feel like the material was designed specifically for me.	O	O	O	O	O
23. I felt I could work at my own pace.	O	O	O	O	O
24. I could have learned more if I was given more time than was given in the computer lab.	O	O	O	O	O
25. I was given answers, but I would like to have someone present who could explain the answers.	O	O	O	O	O
26. I could have learned more if the course information had been presented by an instructor..	O	O	O	O	O
27. I prefer the classes which use the computer over the ones that do not.	O	O	O	O	O
28. I would have liked something to drink while working on the computer course.	O	O	O	O	O

This survey form has been authorized by, and adapted from a Computer Managed Instruction survey developed by Dr. Michael Szabo, University of Alberta.

APPENDIX B

University of Alberta
Department of Educational Psychology

Thesis Title: A Correlational Study of The Relationship Between Selected Adult Learning Styles and Achievement in a Computer Based Course

Consent Form

I have been asked by Lionel Shewchuk, a graduate student in the Department of Educational Psychology at the University of Alberta, to be in a research project which has been approved by the Department of Educational Psychology. I understand that:

- this study looks into the relationship between selected adult learning preferences and student achievement in a computer based instructional course.
- the data collected in this study will not affect my grade or status in the institution.
- all data collected will be identified by an identification number which will be accessible only by the researcher.
- the researcher may have access to my records in the institution strictly for the purposes of the study.
- the data will be collected from January 31, 1997 to March 31, 1997.
- my participation in this study is completely by choice and I may refuse and/or quit the study at any time.
- my name will not be used on any reports associated with this research, or on the final thesis document.
- I may express any concerns I have about the study to the Instructor, the researcher Lionel Shewchuk (Phone Number), or the supervising professor Dr. M. Szabo, Professor in the Department of Educational Psychology, University of Alberta, (Phone Number).
- the data collected leads to a thesis which will be available for examination at the University of Alberta Library.

On the basis of the above statements, I agree to take part in this study.

_____	_____
Student Name (Please Print)	Program of Enrollment
_____	_____
Student Signature	Date
_____	
Student Identification Number	

APPENDIX C

Percentage and Response Frequency Summary of 55 Adult Students in a Post-Secondary Institution to an Attitude Toward Computer Assisted Instruction Survey Form

Item	SA	A	U	D	SD
1)I prefer to learn new concepts in a classroom setting with a group of people.	18% n=10	36% n=20	16% n=9	22% n=12	7.3% n=4
2) I like to have new information explained to me by the instructor before I really learn it.	18% n=10	35% n=19	22% n=12	25% n=14	0% n=0
3) I like to sit in a comfortable chair when I am working on a computer lesson.	45% n=25	44% n=24	9.1% n=5	1.8% n=1	0% n=0
4) I feel unattended and alone when I am working on the computer.	5.5% n=3	11% n=6	3.6% n=2	53% n=29	27% n=15
5) Operating the computer makes it too difficult to concentrate on the course material.	0% n=0	5.5% n=3	7.3% n=4	53% n=29	35% n=19
6) Nobody really cared whether I learned the course material or not.	1.8% n=1	16% n=9	15% n=8	53% n=29	15% n=8
7) The computer made me feel as if I had a private tutor.	1.8% n=1	40% n=22	18% n=10	25% n=14	15% n=8

(table continues)

Item	SA	A	U	D	SD
8) As a result of having studied by this method, I am interested in taking more courses by the computer	22% n=12	40% n=22	24% n=13	11% n=6	3.6% n=2
9) I learn the concepts much faster when I use computer assisted learning.	13% n=7	35% n=19	35% n=19	18% n=10	0% n=0
10) Learning new concepts in a formal classroom makes me tense.	1.8% n=1	15% n=8	11% n=6	71% n=39	1.8% n=1
11) I did not have anyone to talk to and felt frustrated by the learning experience.	1.8% n=1	16% n=9	1.8% n=1	58% n=32	22% n=12
12) I liked the ability to work in the evening and take as much time as needed to answer the questions.	42% n=23	51% n=28	5.5% n=3	1.8% n=1	0% n=0
13) Material which is otherwise interesting can be boring when presented by the computer.	1.8% n=1	13% n=7	22% n=12	55% n=30	9.1% n=5
14) In view of the amount learned, this method seems superior to classroom instruction for many courses.	7.3% n=4	38% n=21	27% n=15	25% n=14	1.8% n=1
15) I would prefer computer assisted instruction to traditional instruction.	11% n=6	27% n=15	35% n=19	24% n=13	3.6% n=2
16) Computer Assisted Instruction is just another step toward de-personalized instruction.	9.1% n=5	36% n=20	25% n=14	24% n=13	5.5% n=3

(table continues)

Item	SA	A	U	D	SD
17) I liked the ability to use the computer in the early morning at home.	15% n=8	49% n=27	22% n=12	9.1% n=5	5.5% n=3
18) I was concerned that I may not be understanding the material.	9.1% n=5	44% n=24	7.3% n=4	31% n=17	9.1% n=5
19) I felt uncertain as to my performance in the programmed course relative to the performance of others.	7.3% n=4	38% n=21	20% n=11	31% n=17	3.6% n=2
20) I was not concerned when I missed a question because nobody was watching me.	3.6% n=2	24% n=13	9.1% n=5	55% n=30	9.1% n=5
21) In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.	15% n=8	27% n=15	15% n=8	35% n=19	9.1% n=5
22) I did not feel like the material was designed specifically for me.	0% n=0	24% n=13	29% n=16	40% n=22	7.3% n=4
23) I felt I could work at my own pace.	45% n=25	51% n=28	1.8% n=1	1.8% n=1	0% n=0
24) I could have learned more if I was given more time than was given in the computer lab.	5.5% n=3	15% n=8	29% n=16	42% n=23	9.1% n=5
25) I was given answers, but I would like to have someone present who could explain the answers.	22% n=12	45% n=25	16% n=9	15% n=8	1.8% n=1

(table continues)

Item	SA	A	U	D	SD
26) I could have learned more if the course information had been presented by an instructor.	11% n=6	20% n=11	27% n=15	36% n=20	5.5% n=3
27) I prefer the classes which use the computer over the ones that do not.	11% n=6	27% n=15	42% n=23	16% n=9	3.6% n=2
28) I would have liked something to drink while working on the computer course.	24% n=13	33% n=18	27% n=15	13% n=7	3.6% n=2

Attitude Survey Summary

On Question 1, 54% preferred to learn new concepts in a classroom group setting. Almost 30% disagreed or strongly disagreed on the same question. Sixteen percent of the students were undecided.

On Question 2, 53% preferred to have an instructor present the information. Twenty-five percent disagreed with having the instructor present the information and 22% of the students were undecided.

On Question 3, 89% of the students preferred to sit in a comfortable chair when engaged in a computer based lesson. Almost 2% disagreed with the question, and slightly more than 9% were undecided on this issue.

On Question 4, 80% disagreed or strongly disagreed when asked if they felt alone or unattended when working on the

computer. More than 15% either agreed or strongly agreed to feeling alone. Slightly more than 3% of the respondents were uncertain.

On Question 5, 5 1/2% strongly agreed or agreed that the computer made it difficult to concentrate on the course materials. Eighty-nine percent responded by disagreeing.

On Question 6, 68% felt that someone cared if they learned the course material. Eighteen percent felt that nobody cared and 15% were uncertain.

On Question 7, 42% of the students strongly agreed or agreed that the computer made them feel as if they had a private tutor. This question was almost evenly split as 40% of the respondents disagreed or strongly disagreed to the same question.

On Question 8, 62% of the students agreed or strongly agreed to a positive computer learning experience and were interested in taking more courses by the computer. Almost 15% of the students disagreed or strongly disagreed. Twenty-four percent of the students were uncertain on further computer learning experiences.

On Question 9, 48% felt they learned the material faster on the computer system. Thirty-five percent were uncertain as to the speed of learning on either mode. Eighteen percent felt they

learned better without the computer and disagreed with the question.

On Question 10, almost 73% of the students disagreed or strongly disagreed to feeling tense while learning new concepts in a formal classroom. Nearly 17% did feel tense in the same learning environment.

With respect to Question 11, 80% of the students disagreed or strongly disagreed when asked if the computer learning experience had been frustrating due to the lack of an instructor present. Approximately 18% of the students agreed or strongly agreed to frustration at the lack of an instructor.

On Question 12, when queried on the ability to work in the evening and spend as much time as needed on a question, 93% agreed or strongly agreed. Nearly 2% did not like the ability to work in the evening.

On Question 13, 15% of the students thought the material could be boring when presented on the computer. Fifty-four percent either disagreed or strongly disagreed. Twenty-two percent of the students were uncertain on this question.

With respect to Question 14, nearly 49% of the students strongly agreed or agreed that the computer was a superior way to learn. Twenty-five percent of the students thought the computer method was less superior, and 27% were uncertain.

On Question 15, 38% strongly agreed or agreed to a preference toward computer managed instruction. Almost 28% of the students disagreed or strongly disagreed showing a preference for traditional instruction. Thirty-five percent were undecided on this preference.

On Question 16, 45% felt that computer assisted instruction was just another step toward de-personalized instruction. Thirty percent of the students disagreed or strongly disagreed to this question. Twenty-five percent were undecided.

With respect to Question 17, 64% liked the ability to use the computer in the early morning at home. Almost 15% strongly disagreed or disagreed, and 22% were undecided on the issue.

On Question 18, 53% were concerned about their understanding of the material. Slightly higher than 40% disagreed or strongly disagreed.

On Question 19, 45% felt uncertain about not knowing how their performance rated relative to others in the course. Over 34% disagreed or strongly disagreed, and 20% were undecided.

On Question 20, 64% were not concerned if they missed a question because no one was watching. More than 27% agreed or strongly agreed that this was an issue.

With respect to Question 21, 42% felt it was important to know how they stood in the class relative to others. Slightly more than 44% disagreed or strongly disagreed to this being a problem. Fifteen percent were undecided on the statement.

On Question 22, 47% felt that the material had not been designed specifically for them. Twenty-four percent agreed or strongly agreed that the material was designed for them. Twenty-nine percent remained undecided.

On Question 23, 96% felt they could work at their own pace. Almost two percent disagreed or strongly disagreed.

With respect to Question 24, 51% did not feel they could have learned more if more lab time had been provided. More than 20% of the students agreed or strongly agreed to this question. Twenty-nine percent were unsure and selected the undecided option.

On Question 25, 67% of the students agreed or strongly agreed that they would have liked to have someone present to explain the answers. Seventeen percent disagreed or strongly disagreed with 16% being undecided.

With respect to Question 26, 31% preferred to have the information presented by an instructor. Forty-two percent of the students felt they learned the same amount of information

without the instructor present. Twenty-seven percent were unsure and chose the undecided option,.

With respect to Question 27, 38% preferred the computer assisted classes over the regular classes. While almost 20% did not prefer the computer classes, 42% were undecided.

On Question 28, 57% preferred to have something to drink while working on computer courses. While 27% were undecided, almost 17% of the respondents disagreed or strongly disagreed.

In general, the Attitude Survey results indicate a positive attitude toward learning by a computer controlled system. Sixty-seven percent of the students had a cumulative score which placed them in a positive attitude category. Although higher percentages in the questions referring to personal instructional intervention indicate a preference for an educator to be part of the learning process, the survey indicated that for the population studied, a computer managed learning system is acceptable.

The actual student scores ranged from 119 to 68. A central mean midpoint determined the division between a negative or positive opinion. Students who scored 91 or less on the survey were considered having a negative opinion, while students who score 92 or greater were considered to have a

positive opinion. The cumulative scores had a mean of 91.9 with a standard deviation of 23.24.