Cognitive Styles and Preferences for Computer-Assisted Learning
in a Self-Paced Second-Chance Environment.

by

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ABSTRACT

This school examined the relationship between students' cognitive styles and their preferences for computer-assisted learning (CAL) in a self-paced, second-chance environment. The data were collected through the utilization of user logs, the Gregorc Style Delineator, and a questionnaire on demographics and computer-use in learning. In order to corroborate these data, interviews were conducted with twenty students who participated in all aspects of the study. Demographic information provided a basis for comparison of the study population with secondary school students, other young adult and adult learning centres, and general drop-out populations in Ontario. Comparisons of age groups and gender were made within the study population and with other reference populations regarding cognitive styles and computer-assisted learning. The present study supported several statements found in the literature regarding an increase in achievement based on either computer-assisted learning resources, the self-paced environment, or both. The study also supported research that suggested changes in behaviour to computer-use would occur when the CAL was more aligned with student coursework and with ease of use, regardless of cognitive style.

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TABLE OF CONTENTS

Abstract ii
Table of Contents iii
List of Tables v
List of Figures vi
CHAPTER 1: INTRODUCTION 1
Students 2
Learning Style 3
Computer-Assisted Learning 4
Statement of the Problem 5
Importance of This Topic for Education 7
Definition of Terms 8
CHAPTER 2: REVIEW OF THE LITERATURE 11
Students in Second-Chance Environments 12
Second-Chance Education 12
Non-Traditional Students 14
Adult Learners 15
Summary 17
Conditions for Learning and Cognitive Style 18
Learning Theories--An Historical Perspective 20
Developing the Ability to Learn 21
Adult Learning 24
Student Learning Styles 25
Cognitive Styles 27
Gregorc Style Delineator 29
Summary 30
Computers and Learning 32
Impact of Technology 33
Computer-Assisted Learning (CAL) 34
Open-Ended Learning and CAL 35
Evaluations of CAL 36
Summary 38
CHAPTER 3: RESEARCH METHODOLOGY 40
Research Questions 40
Research Design 42
Data Interpretation 43
Educational Program and Student Characteristics 44
Instrumentation 47
Pilot Study 48
User Logs 49
Gregorc Style Delineator 50

Questionnaire on Demographics, Computer-Use and Learning... 53
Interviews... 54
CHAPTER 4: RESEARCH FINDINGS... 56
User Logs... 56
Demographics... 59
Cognitive Style... 67
Frequency and Distribution of Cognitive Styles... 69
Significant Differences in Cognitive Styles... 73
Computer-Assisted Learning... 76
Correlations Within Computer-Assisted Learning... 76
Cognitive Style and Use of CAL... 78
Interviews... 80
Cognitive Style... 81
Second-Chance Environment... 82
Learning and Computers... 84
Summary... 86
CHAPTER 5: DISCUSSION AND INTERPRETATION... 88
Demographics... 88
Cognitive Styles and Age-Related Learning... 91
Cognitive Styles and Computer-Assisted Learning... 95
Summary... 103
Demographics and the Second-Chance Environment... 104
Cognitive Styles and Second-Chance Students... 105
Cognitive Styles and Computer-Assisted Learning... 107
CHAPTER 6: CONCLUSION... 110
Interpretation of the Findings... 110
Limitations of the Research... 113
Implications for Alternative Schools... 117
Recommendations Based on This Research and the Literature... 118
Suggestions for Further Research... 120
REFERENCES... 123
APPENDIX A: Letter of Informed Consent... 135
APPENDIX B: Demographics, and Computer-Use and Learning Questionnaire... 136
APPENDIX C: User Logs... 140
APPENDIX D: Gregorc Style Delineator... 141
APPENDIX E: Information Sheet... 142
APPENDIX F: Butler's Style Channels (abbreviated)... 143
APPENDIX G: Student Interview Questions... 144
APPENDIX H: ABE Questionnaire (taken from Thomas & Buck, 1994)... 146

LIST OF TABLES

Table 1. Variety of CAL Used by the Students 58
Table 2. Type of CAL Used 59
Table 3. Demographic Sample by Age and Gender 60
Table 4. Occupations of Father, Mother, and Self by Age and Gender 62
Table 5. Student Responses to Past Education by Age and Gender 64
Table 6. Student Recall of Achievement During Last Years of REGULAR Schooling 65
Table 7. Students' Average Grades by Age Based on School Records 66
Table 8. Student Reasons for Leaving REGULAR School 67
Table 9. Cognitive Style Sample of Students by Age and Gender 68
Table 10. Distribution of Dominant Cognitive Styles 70
Table 11. Comparison of Cognitive Styles by Age Group and Gender 72
Table 12. Analysis of Variance Between Young Adults and Adults With the Dependent Variable Cognitive Styles 73
Table 13. Analysis of Variance on the Group for Cognitive Styles Based on Gender 75
Table 14. Correlation of Variables with Positive and Negative Learning Aspects of Computers 77
Table 15. Correlations Between Researcher and ABE Questionnaires 78
Table 16. Student Use of CAL Based on Most Dominant Cognitive Style 80
Table 17. Comparison of Cognitive Style for the Interview, Delineator, and Demographic Samples 81
Table 18. Past Positive and Negative Learning Experiences 85
Table 19. Comparison of Cognitive Styles Among Selected Study Age Groups 94

LIST OF FIGURES

Figure 1. Number of students in the cognitive style sample by age and gender..... 69
Figure 2. Cognitive style of students by gender..... 71
Figure 3. Comparison of young adults and adults by group scale means..... 74
Figure 4. Comparison of cognitive styles among three age groups..... 75

CHAPTER 1: INTRODUCTION

Education has become a life-long experience for many people as they attempt to maintain their jobs, to improve their positions, or to generally cope with the technological changes which have occurred in recent years. Until recently, people who had discontinued their education before high school graduation had been left to fend for themselves by accepting low-paying jobs, in attempting employment entry programs, or to creatively present themselves to employers who did not require highly skilled workers. The nature of the work place has changed dramatically in recent years and people with few skills soon found themselves without work or found themselves in danger of losing their jobs. Governments and educational institutions have recognized the need to involve undereducated people in an environment conducive to their successful completion of secondary-level education. Several types of alternative schools have been established for young adult drop-outs, for adults seeking skills for job searches, and for those people seeking upgrades for postsecondary entrance requirements. The present study focused on three concerns found within an alternative educational environment: the nature of students seeking an education in a storefront school environment; the learning styles displayed by these students; and the preferences for available technologies and software used by these students.

Students

This study concentrated on young adults and adults who had not completed their secondary education due to a variety of reasons, many of which were related to those reasons associated with drop-outs as portrayed in the literature. Some of these students had completed general high school requirements or the requirements of years past, but they did not meet present entrance expectations of colleges or universities. The study included a sample of students drawn from young adults (16-22) and adults (23-56) and it occurred within a self-paced, open-ended learning environment. The educational environment was unique for a storefront school since the students worked independently toward secondary level diplomas by completing correspondence courses which were supplemented by Adult Basic Education (ABE) materials, computer courseware, and with the assistance of on-site tutors.

Difficulties may arise when including young adults (16-22) with adults in education centres since research on and theories of adult learning and adult development indicate different patterns of learning and development between adults and young adults. Tennant (1990) suggested that educational opportunities should occur across the life span due to changes in demographic patterns, sexual division of labor, length of one's working life, hours spent at work, and retirement age. Any considerations for expanding educational opportunities should include

adults who are returning to upgrade in response to the effects of social, economic, and technological change.

Learning Style

The present study resulted from the challenge of meeting a wide range of student needs in a second-chance school environment. The school offered a wide range of subjects (grade 8 to grade 12) within a context similar to that of an office or library. The researcher determined that the learning emphasis on the part of the tutors and the students was most similar to the theory of the humanists and somewhat similar to the critical theorists: support the personal growth of the learner while accepting a shared responsibility for the direction of that growth with the student. Another learning theory consistent with this type of environment, which involved both school age and adult students, would be the constructivist learning theory: learning through the personal construction of knowledge.

When resources were selected, questions arose regarding the matching of resources to a wide variety of cognitive styles and the factors of gender and age. Of the several learning styles mentioned in the literature (cognitive, affective, and physiological), cognitive style was chosen as the emphasis since the study included the use of computers and software. Cognitive styles are information processing models which subdivide into reception styles and concept formation styles. The affective and physiological styles were not considered to be as dominant as cognitive styles in this environment because the students chose

whether or not to attend and they had many personal choices not readily available in regular school settings. The Gregorc Style Delineator was selected as part of the research to enable the learners to become more aware of their preferences in learning and to encourage them to become more responsible for their own learning.

Computer-Assisted Learning

Selection of appropriate computer applications and other technological support for the students became another focus for this study. A natural extension of the learning how to learn theory, and the taking over of their own learning by the learners, was the inclusion in the study of the use of computers and related software (CAL). The emergence of new technologies has created a new impetus for reconsidering the importance of the learning environment. Technical breakthroughs in this century have not necessarily provided a more productive student in terms of course completion rate or in achievement nor have they replaced the teacher as instructor. Media selection as a substitute for the teacher, or for one another, can be reduced to a matter of efficiency and quality of instructional methods. Even the enrichment value of computer-assisted learning (CAL) has been shown to be dependent on motivation where the learner has sought new thrills after a short period of time (Kerres, 1995). The correct match between learning style and computer application requires more research.

Although adult educators are expected to facilitate greater independence in learning, they should ensure that nonproductive time in a technological environment is kept to a minimum and that mastery or content completion has effectively occurred (Lewis, 1989). Similar statements have been proposed in adult learning theory by Brookfield (1986) and Cranton (1992). An emphasis was stated by several researchers to ensure that careful integration and application of the new technologies and programs into the learning environment has occurred (De Bruijn,1993; Foshay,1994; Lewis).

Statement of the Problem

The majority of research on learning theory has occurred within a traditional instructional environment and has consisted of cohorts of similar learners. Studies (Fahy, 1992; O'Brien, 1994) have included a various, but narrow, range of learners (elementary, secondary, postsecondary, and adult), directed learning environments, and learning styles. However, most studies have centered on achievement or improvement in study habits. Although educators and researchers involved with educational reform, school restructuring, and innovative practices have studied the concept of learning styles, this area of inquiry remains an emerging one (O'Brien, 1994).

In this study an historical account of learning theories will culminate with a choice of a learning theory which has been proposed by Hannafin et al (1994)--the empowerment of learners in an open-learning environment--and which closely

follows the constructivist theory of learning. Adult learning theory (Brookfield, 1989; Knowles, 1975,1980,1989; Knox, 1981; Lovell, 1980) closely parallels this paradigm by fostering adults' capacity for self-direction. Assisting the learners to become aware of their dominant learning styles presents an opportunity to enrich their learning environment and to improve their processing of information and related skills (Dunn & Griggs, 1988).

The implementation of new technologies in an educational environment is usually left to the teachers. Success or failure of the innovation depends mainly on the teachers' abilities, with their intentions of use and with their perceptions of the worth of the particular technology (Burger, 1995). Despite displaying a greater familiarity with computers and providing a wider range of uses for computers, educators have been slow to integrate computers into the learning environment in ways which change the learners' experiences (Fahy, 1992).

The purpose of this study is to explore adult (23-56) and young adult (16-22) preferences for CAL based on their cognitive styles, as perceived by Gregorc (1982), in a second-chance school setting. Comparisons will be made with findings in the research literature for similar, second-chance learning environments, secondary schools, and ABE (Adult Basic Education) centres. The opportunity exists to compare the cognitive styles, the CAL preferences, and the demographics of young adults and adults within this study and with related studies.

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Importance of This Topic for Education

There has been a move toward non-traditional learning environments in the past several years. Some students have opted out of the traditional high school setting, some adults without formal secondary training want to complete their secondary education, and some parents who do not want their children's belief systems eroded are opting for home-schooling or charter schools. Many school districts are establishing alternate, or second-chance schools to meet the needs of a variety of these learners. However, the question remains, are the needs of these learners being served?

As the second-chance environment becomes more commonplace, and the technology choices more diverse, informed decisions will be required in order to provide the learners with an effective learning environment. Interest in open-ended learning environments has grown and when combined with recent developments in technology, this interest should expand (Hannafin et al, 1994). Uncertainties remain in the research literature which include incomplete understanding of the learner and the manner of anchoring required course content within meaningful, authentic contexts. Although some researchers (Gathany & Stehr-Green, 1994; Kerres, 1995; Siegel & Sousa, 1994; Velayo, 1994) have specific suggestions for providing technologies within authentic contexts, the relationship between the cognitive style of the learner and the matching of available technologies is not addressed. The question remains how to utilize the

technologies in a particular program to meet the needs of the learner (Foshay, 1994).

The feasibility of implementing technology should consider the user readiness of the learner (Hannafin et al, 1994). With the advent of multimedia and hypermedia technologies, such as CD-ROM, teleconferencing, and the internet, methods to incorporate these into the learning environment will be required. A study exploring the match between learning style and effective resources would address such needs; specifically, research on cognitive styles among young adults (16-22) and adults (23-56) in a secondary setting (O'Brien, 1994).

Definition of Terms

The review of the literature revealed terminology which was introduced in the past and had since gained various connotations, or was introduced recently to explain specific phenomenon, instruments, learning resources, or equipment. The following definitions have been included to clarify the present researcher's interpretations of, and uses of widely used terms.

1. Non-traditional students--students sixteen and over who receive their secondary education outside formal school settings. These include adult re-entry students with incomplete secondary school preparation (Beaty & Chiste, 1986), teenage parents or single parents (Imel & Kerka, 1990), alienated youths (Malmberg, 1983), special needs students such as young offenders (Wermth & Maddy-Bernstein, 1989), and talented students wishing completion of

secondary academic courses or programs in an unstructured environment. These students do not necessarily include male and female students pursuing non-traditional occupations (Imel, 1989; Ohio State University, 1986) nor vocational students (Cusick & Wolfe, 1985).

2. Second-chance education includes alternative education routes which enable people aged sixteen and over to improve their secondary education and to engage in life-long learning. As Levin (1991) suggests, institutions should disregard the "how, when or why they left school." Such alternatives would encourage student success and would allow curricular choices based on interest and motivation. Certification should include some variety based on student needs. Programs should be organized to include full and part-time working students.

3. Cognitive style is a term used by Gregorc (1982) to reflect the outward appearance of an individual's mediation abilities. These mediation abilities are the power, capacity, and dexterity to utilize channels of the human mind through which the mind receives and expresses information efficiently and effectively.

4. The Gregorc Style Delineator is designed to reveal two types of mediation abilities: perception and ordering (Gregorc, 1982). Perception enables the individual to grasp information along some continuum of abstractness through concreteness. Ordering demonstrates how an individual authoritatively

arranges, systematizes, references, and disposes of information along a continuum of sequencing through randomness. These mediation abilities are revealed by us in transacting and adapting to our everyday environments.

5. The term technologies will be used in this study to include any application of computer hardware. Modems and faxes have linked telecommunications to computers. These, in conjunction with improved optical scanners, have enabled interaction between teachers and learners in distance education. Teleconferencing and videoconferencing connect different locations by using the above along with fiber optics. Multimedia is available through the connection of CD-ROM drives or videodisc players with computers.
6. Computer-assisted learning (CAL) includes courseware which provides immediate, individualized and informative feedback, remedial instruction, competency-based techniques for drill and practice, and integrated learning systems. Applications suited to match students' coursework also include word-processing, data-processing, accounting, and information searches. Several terms have been included under the umbrella of CAL for purposes of simplicity -- Computer Assisted Instruction (CAI) (Arenson, 1982; Rochet, 1984; Tatsuoka, 1984), Computer-Managed Instruction (CMI) (Blickhan, 1992), and Integrated Learning System (ILS) (Becker, 1992).

CHAPTER 2: REVIEW OF THE LITERATURE

The task of educating citizens has become more complex over the past several decades in many countries. Within school districts, child-centered models of education at the elementary levels coexist with the post-secondary driven curricula which are found at the secondary levels. Choices of careers and opportunities to change those careers have mushroomed to the point where retraining and upgrading have become a lifestyle as evidenced by the growth of programs offered and supported through government funding (Rumberger, 1990).

Questions related to this trend and asked in this study are theoretically based in three areas of the research literature. The first area introduces the nature of students in a non-traditional role. These students, including both young adults (16-22) and adults (23-56), will be studied in a second-chance environment which is specifically an Adult Drop-in Centre sponsored by a school district. The second area includes research about the conditions for learning and the cognitive style. An historical approach to learning theories (Phillips & Soltis, 1991), to adult learning and development (Brookfield, 1989; Cranton, 1992; Knowles, 1975, 1980; Knox, 1981), and to learning styles (Claxton & Murrell, 1987) will culminate in the choice of an instrument to be used in the study, the Gregorc Style Delineator. The final area addressed in the research relates to the implications of computer-assisted learning (CAL) on learning in an open environment. One of the foremost

complexities of educating citizens, will be to match their learning preferences to the myriad applications of technologies in learning environments (Hannifin et al, 1994; McCallister, Back, Seaman & Pevoto, 1988; Siegel & Sousa, 1994; Velayo, 1994).

Students in Second-Chance Environments

Many students find themselves caught up in career choices, which are reflected in their subject choices, at a stage in their lives when the majority of these students are not prepared for crucial decisions (Head, 1986). At-risk students find that their needs are not being met in the classroom. As outside pressures increase, decisions are made by these students to leave school for the time being (Price Waterhouse, 1990; Radwanski, 1987; Sullivan, 1988). With an emphasis on retaining students in school, little attention has been applied to enable people to return to school to complete their education. Current efforts are based on the belief that sequential schooling and school completion as presently posed are the most efficient route for all students (Levin, 1991). Further, some students are removed temporarily from regular school classes, some mode of behavior and social training is provided, and then they are re-entered into the regular school to complete their programs (Wessing, 1991).

Second-Chance Education

A philosophy which embraces the development of the power within people to critically perceive their existence within the world and then to transform

themselves is offered by Freire (Clark, 1993; Cranton, 1992; Greene, 1990; Kyle, 1995). By realistically analyzing their situations, people could deliberately change things. Independent self-activity should empower individuals to think and act. Resulting new ideas and investigative skills would lead to self-regulation, personal satisfaction and social responsibility (DeBoer, 1991). Students would have the opportunity to embrace this philosophy in a second-chance educational environment.

Several studies have indicated that returning students had more positive experiences the second time, expected more relevancy of the school curriculum, and anticipated improved job prospects (Levin, 1991; Wessing, 1991). A caring and committed staff in a non-threatening, learning environment completed the desired setting for a second-chance education (Inbar, 1990).

However, several researchers stated that there is no best program for all students. If non-traditional students enrolled in a science program, female students would arrive with more anxiety about science and with less confidence in their ability to do science, than their male counterparts (Tobin, Kahle, & Fraser, 1990). Further problems arise for individual students when courses vary from a more literal to a more mathematical context, from a more concrete to a more abstract format, and from more familiar terminology to a more complex or unaccustomed vocabulary (Ferko, Jacobson, & Doran, 1991). To meet these individuals' needs

and to improve required visual-spatial abilities, support in the form of guidance and resources would be necessary (Whyte, 1986).

Non-Traditional Students

The majority of research has been conducted on the characteristics of drop-outs and their reasons for dropping out (Inbar, 1990; King, Warren, Michalski & Peart, 1988; Levin, 1991; McLeary Smith, 1995; Wessing, 1991). Several factors identified from these studies and mentioned previously were the relevance of subjects, achievement, attitudes toward school and the subjects, home background, and occupational expectations (Price Waterhouse, 1990; Radwanski, 1987; Sullivan, 1988). While efforts have been concentrated on retaining students in school, little has been done to provide re-entry for adolescents and adults who wish to return and complete secondary schooling in an individual and flexible setting--dropout recovery (Inbar, 1990).

Most alternative programs are "rehabilitative" in nature and involve a return of students to regular programs before graduation can occur (Levin, 1991; Wessing, 1991). However, there is a need for non-traditional students to enter programs that offer flexible hours and course completion at the student's own pace. Self-directed and individualized programs can assist these students to meet their own goals while working to support themselves. Those students who have been unable to cope with the demands of regular school settings (regular attendance, attention to instruction, appropriate social behavior in an instructional

setting) would now receive attention on an individual basis as required or as sought (Wessing, 1991).

Adult Learners

An analysis of 50 years of research in traditional classrooms revealed that direct influences, including metacognitive processes, cognitive processes, and student-teacher social interaction, had the greatest influence on student learning (Wang, Haertel, & Walberg, 1994). Educators have recognized that adults have learning characteristics in addition to those common traits found in all learners. Special recognition should be given regarding the fact that adult learners: need respect, are autonomous and self-directed, are goal-oriented, are relevancy-oriented, are practical, and have accumulated personal life experiences (Cantor, 1992; Ference & Vockell, 1994). In planning learning activities for adults, the critical elements are motivation, reinforcement, retention, and transfer (Cantor; Heimlich, & Norland, 1994). An overall strategy should be to help adult students learn how to learn. Several studies on adult education including post-literacy and continuing education (Dave, Ouane, & Perera, 1988), adult basic education (Bossort, Cottingham, & Gardener, 1994; Collett, 1990), and occasions for learning (Thomas, 1991) have reinforced this notion.

Although all learners exhibit characteristics which are based in theory, adult learners--and other non-traditional students to some extent--are recognized for possessing or desiring certain traits to a greater degree than those learners in

traditional settings. The context in which adults find themselves can create varied learning occasions of entry or passage (Thomas, 1991). Some adults enter society as immigrants, guestworkers, or refugees and are not provided with an education as easily as children. These same adults are assumed to integrate into the larger society through the environments of employment and civic life. However, ethnic grouping can reduce the need for these adults to acquire language instruction and further learn-how-to-learn abilities, as they learn only how to cope.

Life cycle phases have been proposed for adult stages of growth (Cross, 1981; Knowles, 1980; Knox, 1981; Lovell, 1980). These phases reflect the situations and subsequent changes that adults experience personally and socially. Lovell suggested six stages which encompassed the adult phases of life:

16-20	transition from juvenile to adult
20-25	early adulthood
25-40	consolidation of private/occupational roles
40-60	middle age
pre-retirement	
retirement	

Knowles and Knox refer to three general subpopulations of adults: young adults (18-35), middle adulthood (35-55), and older adults. Cross (1981) yielded useful descriptions of individual's developmental phases and, although the author emphasized that learners' descriptions do not necessarily match their chronological ages and do not fall consistently within one phase, the first five suggested age groups and related phases could have some significance for this study:

18-22	leaving home
23-28	moving into the adult world
29-34	search for stability
37-42	becoming one's own person
45-55	settling down

The passage to adulthood opens up the possibilities of learning for the non-traditional student. Those who opted out of traditional education can now re-enter the formal educational process, but with control over their future. These students require support and guidance in learning how to learn. Barriers to education come with adult responsibilities which do not affect the learning of younger students. Prior experiences for adult learners include the rules or boundaries of accepted behavior which have been internalized. However learning took place may be an internalization that becomes "baggage" for the adult who enters a new learning environment (Heimlich & Norland, 1994). Adults may lack time, money or they may have childcare or transportation problems (Cantor, 1992). Thus, any time spent by an adult in an educational setting must be seen as relevant, and must be positively reinforced.

Summary

The concentration of research has been on learning that occurs in traditional classrooms, or rehabilitative alternate classrooms. Research related to adult education has been restricted to areas of literacy, adult basic education, and continued education. The predominant features of these programs include

traditional classroom settings and some form of teacher delivery system (Bossort, Cottingham & Gardner, 1994; Cantor, 1992).

Certain characteristics which occur in all learners are more predominant in adult learners. Educators must become aware of these traits and plan for guiding and supporting adult students to include these concerns. The context from which adults emerge to engage in learning is quite different from that of children and teenagers (Collett, 1990; Heimlich & Norland, 1994). However, the direction research is taking is to enable the adult to learn-how-to-learn.

Conditions for Learning and Cognitive Style

Attempts at linking student learning styles to learning situations have been plentiful during the twentieth century. Thorndike's "connectionism"--a science of behavior--, Taylor's efficiency through scientific management, Dewey's child-centered, experiential model, and Tyler's means-ends approach reflected the moods of the eras and initiated school reforms. As each educational theory on teaching and learning evolved, a variety of schools developed physically and philosophically to implement the current beliefs. Innovative programs and classes successfully flourished until external factors such as political, economic and global competitiveness, and academic influences created demands for a return to standardization (Eisner, 1994; Fullan, 1991). Similar situations have occurred over the past several decades (Feldman & Atkin, 1993; Fensham, 1993; Prideaux, 1993) where school reforms have become grounded in standardization with

expectations of improvement in student performance (Eisner). Hein (1991) stated that the demonstrated existence of viable alternative practices is a necessary condition for change.

Learning can be viewed from several perspectives: experiential (phenomenological), behavioral, and neurological (Schmeck, 1988). Schmeck synthesized these arguments into a definition of learning which integrates mental contents and functions for the promotion of a versatile individual. A cognitive style is indicated through a bias in a chosen strategy where subtle situational variations are ignored (Pask, 1988; Schmeck). Cognitive styles are characteristic modes of thinking, remembering, and problem solving which vary across individuals and are related to personality differences (Ramsden, 1988). Outward appearances of an individual's ability to receive and express information further defines cognitive style (Gregorc, 1982).

The learning style of adults is impacted by: tension between cognitive growth and decline in adult years; status of normative versus the non-normative concepts of the life course; relevance of the contextualization of knowledge; and the nature of the impact of accumulated experience (Tennant, 1990). Adult learning capacity expands as one learns how to learn. The difference in the learning strategies is that increased age brings about a decline in fluid intelligence (rote memory, quickness) but an increase in crystallized intelligence (wisdom, experience). Several researchers have suggested that educators should facilitate

the adults' capacity for self-direction and autonomous learning (Boucouvalas, 1989; Brookfield, 1986, 1989; Cranton, 1992; Tennant, 1990).

Learning Theories -- An Historical Perspective

A variety of theories have suggested that different sorts of learning exist and that a teacher's help in the learning process may be vital in many situations. Classical theorists such as Plato and Locke determined that experience was something that happened to a learner. While Plato's pupil was a spectator of reality, Locke's student was mindless, waiting to be filled. Learning for the behaviorists such as Skinner was the result of the environment acting on the learner, where the learner was rewarded for acting in acceptable ways. Gestalt psychologists used a mental phenomenon of learning where tendencies of the mind to pattern and structure experience were investigated. Dewey developed a learning theory based on meaningful student experiences and genuine student problem solving. A biological approach was taken by Piaget who viewed learning as an organism adapting to its environment. However, Phillips and Soltis (1991) stated that these theories considered learning as an individual phenomenon to the exclusion of the social dimension of learning.

The social aspects of learning included Vygotsky's potential for learning notion where one learns with the guidance of adults or peers, and where one learns by imitation. Recent theories include transformational learning and the interactive-constructive model of learning. Clark (1993) synthesized the ideas of

Mezerow, Daloz, and Freire as humanistic, with a constructionist view of knowledge, and leading to a democratic vision of society where individuals assume the responsibility for their collective futures. The personal construction of knowledge for Roth and Yore (1992) involved cooperative learning and other social interactive teaching approaches which promote learning how to learn. Subsequent discussion on learning theory in this study will relate the personal construction of knowledge with Dewey's meaningful experiences.

Developing the Ability to Learn

Trends in secondary science education appear to parallel those in learning theory and therefore serve as an example of change and implementation which do not create the desired effects. Definite changes in science curriculum have occurred over the years 1970 through 1984 (Keeves, 1992). There were new emphases on history and the nature of science, environmental science, technology and its applications to science, and the social and ethical implications of science. Simultaneously, changes were occurring in the processes of science: the methods of science were highlighted; the significance of attitudes, interests and values were considered; and the power and limitations of scientific methods were recognized. However, the development and learning of science at the secondary school level was based on the dictates of higher level institutions, or centralized examinations (Ferko, Jacobson & Doran, 1991; Rosier & Keeves, 1991). The content of textbooks and of externally imposed examinations (Rosier & Keeves, 1991), rather

than mandated curriculum, and teacher perception of the contents' importance to examination items (Connelly, Crocker & Kass, 1989) affected the students' learning. Thus, more than curricular change for science improvement needed to be pondered (Dunn & Griggs, 1988).

Alternative conditions for learning science and other subjects should be considered. Duschl (1990) stated that "minds-on procedural knowledge guidelines" enable students to personally construct, revise, and alter scientific knowledge. Roth & Bowen (1994) stressed the need for authentic practice where the students' learning would be enhanced when they designed their own projects and shared their findings with their peers. The interaction of prior knowledge with the meaningful learner orientation successfully predicted the students' attainment of meaningful understanding in a study performed by Cavallo and Shafer (1994). Roth (1995) acknowledged the importance of devices such as computer displays, readouts from various measurement instruments, and drawings or designs in the communication and sense-making of science activities.

The open-ended learning system provides an environment which is heavily influenced by the beliefs of constructivists, where individuals utilize their own sense-making capabilities during learning (Hannafin et al, 1994). Hannafin et al proposed continuums for the dimensions on which the open-ended learning environment was based: scope, content, integration, user-activity, and pedagogical

orientation. These continuums were based on five assumptions which support the concept of open-ended learning.

One of the assumptions underlying open-ended learning environments (Hannafin et al, 1994) includes learner manipulation and creativity. The learners encounter, shape, and revise their own construction of theory based on their personal experience in a supportive, resource rich setting. A second assumption empowers learners in the use of their own strategies. Concept maps and vee-maps were introduced by Roth and Yore (1992) as directed-learning techniques which evolved toward learner-regulated techniques and higher level learning. Other researchers (BouJaoude, 1992; Collister, Farragher & Burger, 1995; Toh & Woolnaugh, 1993) also found that students required specific teaching followed by training in order to perform higher level process skills involved in open-ended investigations and projects--identifying and manipulating variables, interpreting data, hypothesizing and experimenting. Metacognitive strategies enable the learners to make decisions, monitor their own progress, and evaluate their mental constructions. The third assumption cultivates this "self-reflection and thought-based action" (Hannafin et al, 1994). The final two assumptions involve understanding and the means by which learners achieve that understanding. In open-ended learning environments, the learners refine their acquired knowledge through individual experience. Learners become involved in multiple contexts, with varied resources which guide the learners into the higher-order cognitive

skills (Hannafin et al). The challenge for educators is to facilitate the support and guidance necessary for self-paced, self-directed study which is at the opposite end of the continuum from traditional pedagogy.

Adult Learning

Three main paradigms have contributed to the development of adult education: behaviourist, humanist, and critical (Brookfield, 1989; Cranton, 1992). The adult educator, as seen by the behaviourist, acts as a facilitator to ensure that the learners attain previously identified learning objectives. Learning occurs because correct behaviours are reinforced. This type of learning is task-oriented and includes programmed instruction. Brookfield stated that this paradigm is less suited in developing insights or in interpreting experiences. Cognitive and affective processes that occur within the learner would be overlooked (Cranton).

The predominant model used in North America is the humanistic paradigm which encourages the educator, as a facilitator, to empower the learner--support the personal growth of the learner. Cranton (1992) suggested that humanists, in general, support cognitive and affective learning as well as reflection, transformative learning, and changes in self-directedness and learning style. The work of developmental psychologists in proposing adult stages of growth provided goals for the humanist approach (Cranton).

Critical theorists, including Freire, have the educator situated as a co-learner and hold the educator and the learner mutually responsible for growth and

change (Cranton, 1992). Brookfield suggested a similar responsibility for his "facilitator", but he stated that the educator was also morally responsible for contributing to the direction of the adult learner (Cranton).

Student Learning Styles

The research literature is rich in both theoretical presentations of and in studies of student learning style (Claxton & Murrell, 1987; Dunn & Griggs, 1988; National Association of Secondary School Principals, 1979; O'Brien, 1994). However, several learning styles emerged from research and school applications: cognitive, affective, and physiological (Keefe, 1982). Cognitive styles are information processing models which subdivide into reception styles and concept formation styles. Affective styles are motivational processes which include attention styles and expectancy and incentive styles. The final category of styles consist of the biologically-based response modes or physiological styles.

A lack of focus was seen to prevent a clear definition of learning style from evolving. Further, Claxton and Murrell (1987) presented the argument that contradictory research results emanated from a variety of disciplines where different aspects of the learning process were addressed. Although Claxton and Murrell presented a comprehensive overview of theoretical and historical concepts integral to learning style, their studies dealt mainly with post-secondary institutions. Practical aspects of learning styles, such as how students study, have been widely reported, especially in post secondary settings. Other research has

dealt with the theoretical aspects of cognitive and psychomotor psychology. Dunn and Griggs (1988) referred to an ineffective educational system which did not respond to the individual differences involved in learning. Creating an awareness of students' learning styles by teachers produced improved attitudes, achievement scores, and a reduction in discipline problems. The concept of learning style was the trigger for several secondary schools that implemented some form of matching teaching strategies with students' learning styles. The varied methods of implementation did not affect the positive results (Dunn & Griggs). Even if teachers desired to link individual differences of their students with effective instruction, very few learning style identification instruments are reliable and valid in assessing all three of the learning style domains (Keefe, 1982). Further research suggested appropriate ways to develop more responsive instructional environments, based on stylistic and skill differences among learners, on the one hand and attempt to help the learner to become more responsive to the existing learning environment on the other hand (NASSP, 1982).

In open-ended learning environments, learners can choose when and how to learn. The learning of the content is self-paced and learners can modify the curriculum, or ask for the curriculum to be modified for their learning style. Each learner has characteristic differences in the preferred ways that they perceive, organize, and retain information which are called cognitive styles (Keefe, 1982). Since the majority of research has been conducted in traditional classroom settings

where teachers interact with their students in varying degrees, further discussion will concentrate on learning styles best related to open-ended learning environments--cognitive styles.

Cognitive Styles

Most research has reported results on either student study or student cognitive and psychomotor abilities. As the process of studying is only one portion of learning, the present study focuses mainly on the cognitive styles. Two major differences in how we learn are how we perceive and how we process (Butler, 1987; Claxton & Murrell, 1987; Gregorc, 1982; McCarthy, 1987).

Several models have been developed to explain how individuals perceive and process information from the real world. Kolb developed his model based on experiential learning. Although his theory dealt with learning style it also included personal development (Claxton & Murrell, 1987; McCarthy, 1987). Learning, for Kolb, was a four-step process which included Dewey's grounded-in-experience learning, Lewin's active learning, and Piaget's interaction of the person and the environment. The Kolb model begins with concrete experiences which cause reflective observations. Abstract conceptualization is based on integrating observations into sound theories. These generalizations are then used as guides for further active experimentation. McCarthy (1987) indicated that researchers from diverse fields identified similar strands. She incorporated Kolb's model with recent brain research into a 4MAT model. To include the four major learning

styles with "left-and-right-mode processing", McCarthy developed the following modalities: visual, auditory, and kinesthetic. Modalities were the sensory channels through which we receive information. Again, the emphasis here was to develop a model for teacher classroom delivery, but to include all learning styles at least some of the time. Much of the research using Kolb's model and his "Learning Style Inventory" dealt with managers, graduate students, registered nurses, college students, and recently a comparison of high school students with adults (Claxton & Murrell, 1987; O'Brien, 1994). Researchers who did work with elementary and secondary students did not use instruments which effectively test cognitive styles (Keefe, 1982).

A perspective similar to Kolb's was developed by Gregorc. He used the qualitative research approach of phenomenology to investigate learning as it is experienced by the individual human mind. Gregorc (1982) developed a Mediation Ability Theory which provided an organized way to consider how the mind works. Four types of mediation abilities are perception, ordering, processing, and relating. Clues as to the individual's inner nature and the capacity of one's mental makeup can be revealed through the individual's outer visible style characteristics (Butler, 1987). The model developed by Gregorc was enhanced by Butler in order to develop teaching styles which paralleled the students' learning styles. However, the work was situated in the traditional classroom setting where some delivery was to occur to all the learners some of the time. Butler and

McCarthy (1987) appeared to have similar goals for teaching and learning in classroom settings since Butler also included the bridging techniques using the modalities of visual, auditory, and kinesthetic.

Gregorc Style Delineator

The Gregorc Style Delineator was designed to reveal two types of mediation abilities: perception and ordering. By using phenomenology, "the study of overt behavior and probable underlying causes", Gregorc (1982) attempted to identify how individuals learn and why they learn as they do. He employed a scientifically credible method, using symbols, to collect data in a semi-structured manner. Initial research included data from 400 individuals through taped interviews, written protocols, autobiographical documents, and documents which included Gregorc's perceptions during the research period.

After eleven years of phenomenological research, Gregorc was able to identify that individuals are oriented on continuums between abstract and concrete, and between random and sequential. Further analysis enabled him to couple these qualities, based on information about their interrelationships, into four distinct transaction (mediation) ability channels: concrete sequential (CS), abstract sequential (AS), abstract random (AR), and concrete random (CR). For Gregorc, each of these combinations revealed a particular orientation to life. He discovered that few individuals are equally strong in all four channels and that most individuals are "predisposed" toward one or two of the channels.

Gregorc (1982) listed brief synopses of the style characteristics of the four dominant channels, CS, AS, AR, and CR, based on 15 categories. The instrument, Gregorc Style Delineator, uses words which relate to these categories. Words were used since research from psychological association tests revealed that single words can cause an attractive/repulsive impact upon an individual, and that single words can attract similar minds. The present Style Delineator presents a revision to include general adult audiences. The choice of words reduced linear processing, or logical choice, by using non-parallel construction, and a mixture of nouns and adjectives. This instrument was designed to be completed, scored, and interpreted by the learners. Further self-study was advised by Gregorc where the learners become less dependent and more responsible for their own learning (Gregorc, 1979; Gregorc, 1982). Research based on the Style Delineator occurred mainly at the college level with some study performed with high school students (Claxton & Murrell, 1987; O'Brien, 1994). Research in alternate school settings has provided mixed results from "not statistically different" in cognitive styles, to surprising results of AR and CR style dominance (Kindrachuk, 1992).

Summary

A review of the historical perspective on learning leads to a choice of theories which combine constructivism and meaningful experiential learning. Through constructivism individuals adapt knowledge to describe their experiences (Roth & Roychoudhury, 1994). Students' construction of knowledge can be

affected by the type of learning environment--directed-learning or open-ended learning. The thrust of the research was to move away from directed-learning to the open-ended learning environments in order to accommodate the learning styles of all students (Hannafin et al, 1994; Roth & Roychoudhury; Roth & Yore, 1992). The greatest benefit would accrue to the learners who would be learning how to learn, and who would become more responsible for their own learning.

The manner in which students learn has been reported from diverse perspectives, predominantly in the areas of student study and student cognitive abilities (Claxton & Murrell, 1987; Dunn & Griggs, 1988). Several models were developed to explain the cognitive style--how individuals perceive and process information. Kolb presented a model which included learning style and personal development within an experience-based environment. Kolb's Learning Style Inventory has been used in research, but mainly in the post secondary and business learning environments. A model based on the phenomenological research method was developed by Gregorc. His perspective was similar to Kolb's, but differed in that the step-by-step process of Kolb's model was replaced by a preference for certain style characteristics which lead to one or several cognitive styles. McCarthy and Butler further developed each of these models in similar ways by including modalities in order to teach all of the learners some of the time.

The majority of research and development of theories centered on the traditional classroom with some form of teacher-delivery system. The Gregorc

Style Delineator lends itself to a more open-ended learning environment where the emphasis for both the Delineator and the environment is on the students learning how to learn; taking more responsibility for their own learning. Research has provided the models and suggestions for turning away from directed-learning to open-ended learning. However, more research is required in this endeavor (Foshay, 1994; Hannafin et al, 1994; O'Brien, 1994).

Computers and Learning

To improve independent learning, student successes, and a variety of learning experiences, computer-assisted learning courseware could be introduced along with regular subject materials. The computer permits the effect of changes to be modeled and tested with real or simulated data (Keeves, 1992). Creative thinking and problem solving are involved. Several recent studies (Andaloro, Bellomonte, & Sperandeo-Mineo, 1994; Nakhleh & Krajcik, 1994) indicated the versatility of Integrated Learning Systems (ILS) programs where students benefited from enriched learning environments. Other developments in multimedia and hypertext have promoted open-ended learning where individuals determine what they will learn through exploration instead of acquiring only externally-defined knowledge as proposed by the instructor. Hannafin, Hall, Land, and Hill (1994) emphasized that a shift from designer-managed learning to student-centered learning has occurred as a result of the emergence of psychological perspectives such as constructivism. Learning activities that are situated in open-ended

environments sustain thinking that originates from personal, practical experiences (Roth & Roychoudhury, 1993).

Impact of Technology

A few decades ago, media was considered to consist of print, audio, and visual. Some combinations of these included slides and film. Gradually the latter two, audio and visual, became one unit and were referred to as audio-visual machines or audio-video recorders and players. Presently, a new era of technology has developed as various media have been adapted for use with computers. The term technologies will become synonymous with computer hardware applications.

Similarly computer-assisted learning (CAL) will be used to represent any software application for use with the technologies. Software on computers can be accessed by several different means: floppy disks, hard disks, CD-ROM disks, videodiscs, and through networking. Along with improvements in storage capacity--CD-ROM discs hold significantly more data than floppy discs--come the provision for multimedia and interactive video programs. Although learners are not expected to be responsible for hardware operations, they are expected to maneuver through software programs. The expectation for the learners would be that these programs would be user friendly.

Computer-Assisted Learning (CAL)

CAL, such as integrated learning systems, can help teachers to provide a more enriching educational experience for their students. Teachers can customize instructional plans which suggest remedial work or enrichment activities for the students to complete at their own pace (Charles, 1993; Walker, 1993). Monitoring and adjusting of student programs is essential as well as conferencing with individuals to ensure that specific goals are being accomplished (Blickhan, 1992).

Keeves (1992) stated that large bodies of data could be "stored systematically" and "accessed" in order to test data from the real world against perceived models of reality. Simulations which test the effects of change can augment new ways of thinking and problem solving (Keeves, 1992; Trotter, 1993). Grade 11 students in chemistry were reported to be positively engaged in elaborating their chemical knowledge (Nakhleh & Krajcik, 1994). The researchers indicated that connections were made between "microscopic and macroscopic modes" of thinking about science. A study enabled a diagnostic module to discriminate among different reasonings used by Physics students in Grades 9, 12, 13, and first year university (Andaloro, Bellomonte, Lupo, & Sperandeo-Mineo, 1994). Such computer-based systems, or intelligent tutoring systems, provide interactive and rich learning environments for the students.

A critical component in using CAL successfully was the coordination of teacher-led classroom activities with computer based activities (Becker, 1992;

Blickhan, 1992; Charles, 1993; Sherry, 1990). Becker reported positive effectiveness of CAL only for students at either end of the achievement spectrum. The middle portion of the spectrum performed better during the traditional teacher-delivered instruction. One difficulty arises when coordinating classroom activities with individualized computer programs since there becomes a great diversity of student tasks. Consideration must be given to planning CAL as an educational resource available within a teacher's overall instructional strategy (Sherry). In an open-ended learning environment, there already exist a variety of student tasks and CAL may be quite suited to this context.

Open-Ended Learning and CAL

Given that an open-ended learning environment exists on a continuum which diverges from traditional pedagogy, CAL becomes one of the resources which provides learners with the opportunity to engage in higher-level cognitive skills within an authentic context. Hannafin et al (1994) suggested orientations which focused on everyday problems which then invited the learners to assist in the problem solving. A model is proposed by Velayo (1994) where the outcome of the learners' academic performances depends on the direction and degree of their self-regulated learning, including their engagement and commitment to the task. The challenge comes in the development of CAL which caters to the students' cognitive skills and within the context of an open-ended learning environment.

Teachers must be able to obtain knowledge regarding their students in order to provide a better match between their learning and the proposed learning environment. The role of the teacher becomes one of a facilitator who is a more advanced and experienced learner. Information is now available to everyone. The students now become active and interactive researchers who learn how to handle information effectively (Hannafin et al, 1994; Seigel & Sousa, 1994). CAL offers opportunities for multidisciplinary learning and a provision for access to sources and perspectives related to the content under study.

Design of the CAL systems must not complicate the learners' tasks. Interfaces between CAL and the learner should provide a variety of options for engagement, locating information, and navigating within the system (Dee-Lucas & Larkin, 1995; Hannafin et al, 1994). The significant feature that should be considered is related to adult learners. Although the content should be conveyed accurately, clearly, and realistically, any graphics should appear in cartoon style rather than a flashy, distracting style (Fahy, 1992; Gathany & Stehr-Green, 1994). The greatest gains from the use of the computer seem to occur through planned integration with on-going curriculum, not as a substitute for existing courses (Foshay, 1994).

Evaluations of CAL

Two problems arise when the evaluation of CAL takes place. Becker (1992) discovered that empirical evidence on the effectiveness of CAL was

problematic. Several barriers in evaluating data were selective dissemination, poor evaluation designs, inadequate data collection, poor data analysis and presentation of results, and inadequate description of the implementation of and environment where the system was used. Decisions based on this data would be unfair since generalizations cannot be made from sites and research designs used under different conditions. Criterion measures used to judge the effectiveness of the vendors curricula also varied. Many of the benefits were perceptions not supported by hard data (Bender, 1991).

Of four CAL, integrated learning systems, reviewed (Saanich School District 63, 1995), only TRO Learning System's PLATO was specially designed for young adults and adult learners (Walker, 1993). Several strengths of the system were the alignment of the courseware to British Columbia's curricula and standardized tests, open DOS architecture to import other programs, ease of use by both the student and the teacher, and single station CD-ROM capability. However, major weaknesses exist with the PLATO system. PLATO does not have the multimedia capability which has been deemed necessary for diverse learning styles of any student population. Since the system is not interactive (most responses involve the "enter" key), it allows for only mastery learning and a review of subject matter. Instead of a continuous spiral assessment, the PLATO system requires a repetition of the sequence if 80% mastery is not achieved. As with other CAL of this type, learning is acquired effectively by under-educated

adults (Fahy, 1992; McCallister et al, 1988). Thomas and Buck (1994) referred to Sherry's conclusion that any of the currently available systems can be effective if used in context. Educators need to be aware of the appropriateness of their students' learning styles as well as the systems' strengths and weaknesses in order to effectively design instructional strategies to optimize student learning.

Other CAL systems that have been evaluated include computer conferencing where individuals / groups interact with each other primarily through electronic text. Steps were listed by Velayo (1994) which increased student acceptance of the technology. However, he raised concerns regarding the elimination of nonverbal cues from the communication, lack of accessibility of computer resources, and the delay in communication. The present researcher is aware that video conferencing has been successfully used between Camosun College and Claremont Secondary School in Victoria, British Columbia. The above concerns were not present in the video conferencing. It appears that computer conferencing will be restricted to e-mail, bulletin boards, and the internet where text communication is better suited.

Summary

Hardware and software applications which use computers are continually improving and innovative uses are constantly appearing in the educational context. The technologies include the recent entries of video conferencing, and multimedia components such as CD-ROM drives. With the advent of new optical scanners,

and a merging of various technologies, distance education has become a reality for many more students.

CAL includes various multimedia references such as Encarta 95, and the American Heritage Talking Dictionary. The virtual textbook (Seigel & Sousa, 1994) will empower students of the future to become effective and creative learners. However, the impetus for CAL in any educational setting should be the needs of the young adult and adult learners.

As with telecommunications technologies, we need a better sense of compatibility of what could be and what should be. We have moved beyond Kerres' (1995) substitution of CAL for traditional courseware, to his idea of CAL as enrichment where interactivity, self-pacing and multimedia occur. Yet, to fully realize the possible benefits for the participants, further research is required on adult learning styles within the CAL enriched environment. Velayo (1994) stated that demographic, environmental, and other student characteristics should provide important information in the design and implementation of the technologies and CAL.

CHAPTER 3: RESEARCH METHODOLOGY

The method of research chosen to investigate the questions presented in the following section involved quantitative measurements which were substantiated by qualitative procedures. Several references in the literature suggested improvement in instrument reliability and greater insights to the research by using multiple methods. The design enabled the sample to be described, correlations between variables to be clarified or discovered, and inferences to be drawn about the student population within the Storefront School (Broadmead).

Research Questions

The findings of this study will have implications for students in non-traditional learning environments since these students will have access to computers, modems, and a variety of other technologies which will bring education to their doorstep, but under their direction. Current literature on cognitive styles and computer-assisted learning proposed a move from directed-learning to open-ended learning in order to accommodate all learning styles. Discussion of the characteristics of learners, including adult learners, in alternate education environments culminated in the requirement to address the matching of learners with appropriate learning resources. The information provided in this study will assist teachers in evaluating existing and potential computer-assisted learning. Also, educators within open-ended learning environments may benefit

from the results in their selection of CAL systems and the technologies to supplement standard course materials.

The study will address three major questions:

1. What cognitive styles are displayed by young adult (16-22) and adult students (23-56) in a second-chance environment?
2. Are gender and age differences evident in second-chance students' cognitive styles?
3. Do the factors of gender, age, and computer experience affect second-chance students' perceptions of computer-assisted learning?

Comparisons were made within the alternate school between young adult and adult students and were made with students in other secondary school and alternate school environments. Secondary questions were posed to gain more insights from the sample population. Are there significant differences in the distributions of cognitive styles between adults and young adults? Is there a specific style which is dominant in a second-chance environment? What factors influence students to display certain cognitive styles? Do the cognitive styles of second-chance students match those of secondary school students in general and of adults in general? Is the choice of CAL dependent on age or gender? What factors influence students to use or not use specific computer programs? Do specific cognitive styles match specific groups of computer courseware? Answers

to these types of questions should augment areas of research which are presently vague.

Research Design

The sample taken from the Storefront (Broadmead) School was representative of a unique population of second-chance students and, as a result, required a broad variety of descriptive data to make inferences about the population and to make comparisons with populations from other studies. Correlations between variables were required in order to determine the feasibility of comparing this study with an ABE study (Thomas & Buck, 1994). The predominant statistical method used was a comparison of means between independent groups and the resulting individual effects and interacting effects of the variables.

In this study both quantitative and qualitative analyses were applied to support findings about the cognitive style distribution of, and the choices of computer-assisted learning programs by non-traditional students in a second-chance environment. Support for multiple methods can be found in Borg and Gall (1989), Burger (1995, Easley (1982), and Smith (1982). The quantitative component included computer-user logs, the Gregorc Style Delineator, Butler's style channels questionnaire (abbreviated), and a questionnaire on demographics and the uses of available computer programs. The qualitative component consisted of semi-structured interviews with students on a voluntary basis. A questionnaire

was used in this study to obtain demographic information about the students as well as their perceptions about computer-assisted learning

Data Interpretation

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IT IS ANALYSIS

The quantitative component required that student use of the various CAL systems be recorded over three months for the time period January 15, 1996 to April 15, 1996. User logs were developed and provided for this purpose. Demographic data was obtained from two sources: a questionnaire was completed by students, and the school's records were used. The questionnaire also provided student responses to computer-use and learning. A pilot study was conducted to test the reliability of the questionnaire. The school records included student achievement, both previous and present. The Gregorc Style Delineator provided data about the students' cognitive styles while Butler's abbreviated questionnaire was used to corroborate this information.

The demographic and computer-use questionnaire could be used to explore a variety of relationships between young adults and adults based on the subscales: computer expertise, Windows manipulation, extended use of the computer, positive learning philosophy, and negative learning philosophy. Although no causal relationships could be established, the strength of the relationship between two variables could be discussed. Further, the strength of the relationship between several independent variables, such as student characteristics, and the dependent variable, CAL, could be determined using analysis of variances.

The qualitative component consisted of interviews with 20 students selected from 61 volunteers. Student responses to questions could augment the findings from the quantitative data as well as clarify the strength of various relationships between variables. The main purpose for using this technique, besides completing the picture and providing examples, was to further clarify and further verify any conclusions which might be reached without bias on the part of the researcher. Triangulation of data involves the collection of data from several different sources and by several different means.

Preliminary analysis included cognitive styles frequencies and distribution by gender and by age. Means, reliabilities, and analysis of variance were calculated as required. The analysis of variance was used to determine whether significant differences in responses existed between young adult (16-22) and adult students, and between male and female respondents. The possibility also existed for significant differences in responses using age and gender combinations. Analysis of variance, in the form of a MANOVA, was used to determine whether significant differences existed between selected student characteristics, as independent variables, and the choice of CAL as the dependent variable.

Educational Program and Student Characteristics

Differences are apparent between this school and other alternative schools, both in its environment and in its clientele. The Storefront School (Broadmead) is designed to provide students (16 years and older) with an opportunity to complete

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correspondence courses toward their grade 12 graduation. The program offers academic preparation, either for continuing with post-secondary studies or for vocational training, in an office or library-like setting. The range of ages of the learners varies from 16 years to 70 years.

The Storefront students are expected to be self-motivated and self-disciplined. Students are required to sign an agreement, upon entering the program, which details the behavioral and learning expectations for the students. The main emphasis is on the non-traditional students meeting minimum time requirements of six hours per week, and of displaying consistent progress in their area of study. The agreement is meant to ensure that the serious students are not hampered in their efforts by someone less serious.

The Storefront School (Broadmead) Program is located in a shopping center. There are no formal classes because of the individualized educational programs and flexible schedule of attendance for each student in the program. The 1700 square feet of floor space includes a large well-lit work area, a reception area, an office, a computer room, and some private rooms for testing or for individual instruction.

The program is currently staffed by 3.5 full time teachers who cover a 57 hour work week among them. The staff act as on-site tutors but they are responsible for the ongoing routines, as well as for technology and CAL initiatives. The program is currently open from 9:00 a.m. to 8:00 p.m. (Mondays

to Thursdays), 9:00 a.m. to 5:00 p.m. (Fridays), and 10:00 a.m. to 3:00 p.m. (Saturdays). The curriculum offered includes intermediate levels--Adult Basic Education (ABE), Correspondence School Courses, General Educational Development (G.E.D)--and advanced/graduation levels (Correspondence School Courses). The school offers Adult Graduation Diplomas and Dogwood (secondary school) Graduation Diplomas sponsored through the British Columbia Ministry of Education.

In order to provide complete programs for the students, the staff have obtained and maintained a variety of learning resources, including computers and software. The types of CAL available to the students are:

1. Reference (Low Interactive) — American Heritage Talking Dictionary; Encarta 94 and Encarta 95; ADAMS Essentials (human body); Monarch Notes (literary)
2. Reference (Highly Interactive) — Choices 95 (careers)
3. Service (Application) — MS Word 6.0 (Word-processing); Bedford Accounting; Clarisworks (spreadsheet, database)
4. Learning System — PLATO 5.1
5. Distance Education — (selected students) Netscape/CLN (internet)

The types of technology presently available to students are:

1. DOS based computers with 8 M-ROM, 250 M hard discs, CD-ROM drives, speakers, networked to a laser printer.

2. DOS based computer with 8 M-ROM, 250 M hard discs, CD-ROM drive, speakers, networked to the laser printer, for use as a stand alone PLATO center.
3. DOS based computer with 16-M RAM, 850 M hard discs, CD-ROM drive, speakers, for the reference center.

4. DOS based computer with 8-M RAM, 250 M hard discs, CD-ROM drive, 28.8 baud modem for internet and career preparation.

Future possibilities are:

5. Multi-platform computers (Mac/DOS) for wider range of educational software.

6. Distance Education Center with an optical scanner, modem, and teleconferencing (free cable TV).

Instrumentation

Research questions posed in this study required the use of new, existing, and adapted instruments. The researcher developed a questionnaire, user logs, and a student interview sheet which were specific to the study setting and clientele. The questionnaire required a reliability study to be conducted before the main research could begin. User logs were specific to the CAL used by the students in the sample. The literature review led the researcher to choose the Gregorc Style Delineator for determination of student cognitive styles. The Butler Style Channels was used to corroborate these findings. However, the interview questions were based on those conducted from several similar studies.

Pilot Study

The demographic, and computer-use and learning questionnaire (Appendix B) was developed by the researcher to gather data for comparison with studies involving drop-outs and to gauge the students willingness to use computers. Questions were developed which would be specific to the CAL available in the school and which applied to assistance given to students during their introduction to and the use of the computers. These questions were revised with the help of a colleague and were then grouped into five variable subscales.

In order to determine the reliability of the questionnaire, a pilot study was conducted using 38 students during the week of October 30, 1995. The demographic portion of the questionnaire was not used since a factor analysis would only determine whether the variable subscales (computer expertise, Windows manipulation, extended use of computers, positive and negative learning philosophy) could be reduced to a smaller number of variables. There were 35 questionnaires which were valid for the factor analysis.

The following results were obtained:

computer expertise	(5 items)	alpha = 0.66
Windows manipulation	(4 items)	alpha = 0.74
extended computer-use	(3 items)	alpha = 0.58
positive learning	(6 items)	alpha = 0.78
negative learning	(3 items)	alpha = 0.54

The grouping of the questions within the subscales was tested to determine whether better matches could be established. It was possible that some questions

could function in either of two subscales. However, rearranging the questions within the subscales would not improve the reliability of the instrument, and it would negatively affect the subscale "computer expertise". Although the three-item subscales indicated lower alphas, the questionnaire would be tested for correlation with a similar, existing ABE questionnaire. The decision was made to retain the questions within the original subscales.

The students from the pilot study suggested that a category for "not applicable" be included with the 5-point Likert scale. This was done by the addition of a "0" onto the scale. Other comments were related to computer expertise in general. Several students were introduced to computer-use for the first time, once they had been approached by the researcher to complete the questionnaire.

User Logs

Five methods were used to establish the individual student use of the computer and the specific use of CAL by the individual student: log-in sheets located at each computer, a similar sheet located at the school sign-in station, the researcher's daily journal, a question in the demographic, computer-use and learning questionnaire, and interviews. The log-in sheets (Appendix C) requested information regarding the student's name, CAL used, time in use, and date of use. The log-in sheet located at the school sign-in station would act as a reminder for students to record any computer-use. The researcher kept track, during work

shifts, of the student use of computers by CAL and by date. Since the researcher had tutoring and other responsibilities as well, it was not possible to record accurate time usage. Information from the demographic, computer-use and learning questionnaire and from the interviews were cross-referenced with the logs and with the researcher's journal.

Gregorc Style Delineator

The Gregorc Style Delineator was the primary measurement instrument utilized in the study. A reliability analysis yielded alpha coefficients for the four scales (CS, AS, AR, CR) ranging from 0.49 to 0.70. These coefficients were deemed to be moderately reliable and if the instrument were used as suggested then the reliability would be further enhanced to strongly reliable. The use of representative samples, alternative forms of the test, and observation were suggested by the literature (Conoley & Impara, 1995; Drummond & Stoddard, 1992) in order to improve the reliability of the Gregorc Style Delineator.

A sample of 20 questions (Appendix F), based on Butler's questionnaire, were presented to the students after they had completed the Gregorc Style Delineator. Five questions were included for each of the four style channels and were randomly listed with a Likert-type scale to elicit some response from the students. Students could have one, two, three, or no dominant styles as indicated in Table 10. Analysis of the responses determined that at least one of the student's dominant styles (96%) matched the results from the Gregorc Style Delineator

when a comparison was made with the student's two most dominant styles. The match was at least the reverse of the top two dominant styles (one of which was the most dominant on the Delineator score) for 71% of the students. A match was determined between the two instruments, on the most dominant style from Butler's questionnaire compared with at least one dominant score on the Delineator, for 64 % of the students. The most dominant style was matched between the two instruments for 37% of the students. However, the entire Gregorc Style Delineator was used and compared to an abbreviated Butler's Style Channel Questionnaire.

Permission was obtained for the researcher to use the Gregorc Style Delineator (1982). A letter of informed consent (Appendix A) and the Gregorc Style Delineator (Appendix D) were completed voluntarily by 75 students during the week of January 15, 1996. The sample consisted of 31 males and 44 females. The roster for that week indicated that 115 students were expected to complete at least six hours of work and study on the school premises. The researcher chose to exclude six students for reasons of low-level English skills (1), special needs (2), lack of permission (2) and an age gap (1). Of the students approached, only one chose not to participate.

The nature of the Storefront School and of the non-traditional students necessitates a method of handling student non-attendance or lack of progress. Some of the remaining 32 students who did not participate in the study had been excused for reasons of illness or for previously arranged commitments. The

remainder of the students were either receiving their only warning regarding insufficient progress or insufficient hours spent at the school, or they were in the process of being contacted to return to a two month outreach program (which was initiated for those students who do not complete the hours requirement).

O'Brien (1994) included an information sheet in his study since concern was expressed about the students' familiarity with several of the terms in the Gregorc Style Delineator. A similar information sheet (Appendix E) was presented to students at the Storefront School when the instrument was administered. Each student was given an overview of the development of the instrument as expressed by Gregorc (1982) and of the questionnaire developed by Butler (1987). The information sheet was to be used as a reference whenever the student had some hesitation in ranking any of the 10 four -word groupings. Instructions were given on how to complete the instrument, using examples, in order to prevent errors in ranking and in scoring. O'Brien (1994) and Gregorc (1982) had mentioned possible student errors in completing the instrument.

On completion, the students totaled their scores and determined their dominant cognitvestyles--concrete sequential (CS), abstract sequential (AS), abstract random (AR), and/or concrete random (CR). The researcher checked the individual's total scores against the required sum of 100. Then information was provided to each student regarding his/her own style preferences and mapped onto

a sheet provided. Questions were answered with information referenced from Gregorc (1982) and Butler (1987).

The rankings from the Gregorc Style Delineator were included in a spreadsheet file. Students were assigned code numbers (1-75) based on their age, youngest to oldest. This was determined to be the best manner in which to handle data for comparative purposes.

Questionnaire on Demographics, Computer-use and Learning

The questionnaire on demographics, and computer-use and learning (Appendix B) was administered during the week of February 12, 1996. The revised questionnaire was administered to the student sample three and one-half months after the pilot study. This was done to minimize any "test-wise" effect (Borg & Gall, 1989) which might occur. The time period between the first and second administration of the questionnaire included a Christmas break of three weeks. Of the 38 students who participated in the pilot study, 25 were participants in the present study.

The questionnaire consisted of six questions related to demographics and the original 21 questions which made up the five subscales. The demographic questions, in addition to information obtained from the school's student records, enabled comparisons to be made with similar groups of students elsewhere. Three questions were related to occupations while three were related to past educational experiences.

The five subscales (computer expertise, Windows manipulation, extended computer-use, positive learning, and negative learning) provided information which was used to compare the student's use of computers to their expertise, the students' use of specific CAL to their cognitive style and to their expertise, and to information gathered through the user logs and through the researcher's daily journal on computer-use. In order to compare the student sample with students in other adult education centres who learn mainly through the use of computers, a 14 question instrument (Thomas & Buck, 1994) was attached to the original questionnaire and was made prominent by using a different colored sheet (Appendix H).

The complete questionnaire was presented to the students for comparative reasons and was explained as such. Results were compared with those from other alternate schools, regular secondary schools, and adult education centres. Further, the specific results from the color coded sheet were compared with the results from the adult education centres that relied on computer-use for the majority of student learning.

Interviews

Only 20 students of the 61 vounteers attended the school on Monday, March 11, 1996. The researcher was available for the complete day and he queried only those students who were on the list of 61 volunteers. Two students

agreed to be interviewed on the following Friday since they were contacted near the end of their scheduled stay.

Each student was reminded of their most dominant cognitive style which was determined earlier. Further discussion was conducted regarding the style as presented by Gregorc (1982) and before the interview started. The interviews were of an average duration of approximately 15 minutes and closely followed the questions presented in Appendix G.

CHAPTER 4: ~~RESEARCH FINDINGS~~ DATA ANALYSIS & INTERPRETATION

The research findings were both expected and surprising with some results corroborating other studies and theories found in the literature. Some results led to further suggestions for research since they were unexpected or were inexplicable. This study employed both quantitative and qualitative measures in order to describe data obtained from a sample of students attending a self-paced, second-chance educational environment. Information was obtained and analyzed regarding demographics, cognitive style, and computer-use. Inferential statistics were used to compare age groups and gender within the study sample and between samples of related studies.

User Logs

User logs were situated at the school sign-in station, and computer stations while the researcher kept his own journal of student computer-use. The logging on of students at each computer site was not an option, since only the PLATO learning system had that feature. Student answers to computer-use were recorded in the questionnaire and during the student interviews. The researcher snapshots of student computer-use were more aligned with the student responses from the questionnaire than with the information obtained from the actual logs situated by the computers and the school sign-in station. Since the researcher was not

available during all school hours, the questionnaire was deemed a reliable source of information regarding student computer-use (see Appendix B).

The time framework allotted for the research proved to be a busy period for all staff, including the researcher, and limited interaction was made between the researcher and other staff members with regard to the research project. Duties of all staff members increased substantially because of increased enrollment (1994--104 FTE; 1995--155 FTE; 49%) and increased hours on-site that students chose to attend, reflected by the increased number of students in attendance during any given hour. Duties of staff on a daily basis included administrative chores (registrations, contract breaks, curriculum development, computer upgrades and program monitoring) as well as a heavy tutoring load.

The student log-in sheets were effective initially, but students had to be reminded to log-in. The students generally had a single purpose in mind, finish the activity because time is important. The researcher was aware of students using the distance education site but had not provided a log-in for this area since it had limited use and required the presence of a staff member. The use of the reference computer was probably higher than indicated as each tutor would engage students here during their search for meanings or for extra information. The short duration of use per event may have dissuaded the students from logging in. The PLATO learning system was used by many students before the research time framework and use was verified by the researcher through the management system of the

program. Since a close match was obtained between student-reported computer-use on the questionnaire and the researcher's journal, then results from the questionnaire were reported.

The number of students using CAL as well as their regular course materials were 72% while those who preferred working only with course materials were 28%. Of those using CAL (Table 1), 43% used 1 type, 24% used 2 types, and 17% used 4 types of the available low-interactive references, high-interactive references, service applications, learning systems, and distance education. The majority of students used more than one type of CAL.

Table 1

Variety of CAL Used by the Students

	Number of CAL Used						
	0	1	2	3	4	5	Total
Number of Students	18	20	11	6	8	1	64
% of N (N = 64)	28	31	17	9	13	2	100
% of Users (n = 46)	0	43	24	13	17	2	99

The information provided in Table 2 was based on the student questionnaire responses to computer-use (Appendix B). Total student use exceeds N = 64 because students reported use of more than one type of CAL. Students preferred

the service application use of CAL (52%), low interactive references (42%), and learning systems (30%). This manner of use was also recorded by the researcher. Of the service application use, only one student used the data processing program while two students used the Bedford accounting program. The wordprocessor (Microsoft Word 6.0) was the main CAL program used--31 students (48%). Of those students using the low interactive reference CAL, 14 used only one type, nine used two types, and four used all available types (American Heritage Dictionary, Encarta Encyclopedia 95, and Monarch Notes). Other students used CAL as well but they were not part of the sample.

Table 2

Type of CAL Used

	Reference Low Interactive	Reference High Interactive	Service Application	Learning Systems	Distance Education
Student Use	27	11	33	19	7
% of N	42	17	52	30	11

Demographics

The demographic questions were included with the computer-use and learning questionnaire (Appendix B), after time was allowed for "test-wise"

possibilities--three and one-half months. Eleven students were lost to this portion of the study due to their removal from the active part of the school program between January 20 and February 12, 1996. One young adult and 10 adults were removed from the school's active program due to insufficient hours spent at the school or for lack of progress on their courses. The remaining 64 students, 30 young adults and 34 adults, participated in the demographic, computer-use and learning questionnaire (Table 3). Two areas were included in the demographics for comparison with other adult education centres and with other studies--occupation and past education. The occupational categories and past education questions were adapted from Price Waterhouse (1990), Radwanski (1987), Sullivan (1988), and Wessing (1991). Age groups suggested by life cycle phases (Cross, 1981) were collapsed from seven to three groups with the adult groups becoming one group for some comparisons.

Table 3

Demographic Sample by Age and Gender

Age	Male	(%)	Female	(%)	Total	(%)
16-22 (Young Adult)	16	(53)	14	(47)	30	(100)
23-56 (Adult)	12	(35)	22	(65)	34	(100)

A nationwide shift to self-employment and the increase in jobs created by small business during the past decade may account for the greater number of young adults with fathers who are manager/owners relative to the adults whose fathers were not (Table 4). The fewer number of fathers in the manufacturing and resource-based industries could be accounted for by the families' location on southern Vancouver Island and/or the lack of movement to or from large urban areas. Six students (9%) indicated that their fathers were not available during their upbringing.

The shift from the mother as homemaker to the working mother is evident here where nearly three-quarters (73%) of the young adults had mothers who worked full- or part-time. Only one- half (53%) of the mothers of adult students worked full- or part-time. Several reasons could explain this trend: equal opportunity exists in the work place; higher family incomes are required to pay off mortgages in today's market; advances in domestic technologies have enabled the traditional role of homemaker to be redefined; and opportunities for self-employment at home are available.

Young adults preferred professional/technical/cultural (37%), service (27%), and manager/owner occupations (20%). Professional/technical/cultural (56%) and service occupations (21%) dominated the adults choices. Females in both age groups, young adult (50%) and adult (59%), expressed the choice of

professional/technical/cultural occupations. This trend could be explained again by equality in the work place, both monetarily and opportunistically

Table 4

Occupations of Father, Mother, and Self by Age and Gender

Occupation	Father				Mother				Self			
	Young Adult		Adult		Young Adult		Adult		Young Adult		Adult	
	M	F	M	F	M	F	M	F	M	F	M	F
Professional, technical, cultural	4	6	5	6	5	3	0	6	4	7	6	13
Manager/owner	6	5	2	4	3	1	1	0	4	2	2	0
Service	4	2	3	7	2	4	3	4	5	3	2	5
Clerical	0	0	0	0	2	1	2	0	0	0	0	3
Agricultural/ fishing/logging	1	0	0	1	0	0	0	1	1	0	0	0
Manufacturing	0	0	2	0	0	0	1	0	1	0	1	0
Homemaker	0	0	0	0	3	5	5	8	0	2	0	1
Other	1	1	0	4	1	0	0	3	1	0	1	0
Totals	16	14	12	22	16	14	12	22	16	14	12	22

.Other factors to be considered by students are the decline in traditional jobs, choices by employers for candidates with a wide variety of experiences and already trained, and the rapid change of the work environment.

In order to compare this student sample with other alternate education and adult education centres, the demographic section of the questionnaire included three questions about the students' past education: reasons for dissatisfaction, achievement, and reasons for leaving school. Storefront School (Broadmead) students indicated (Table 5) that their dissatisfaction with REGULAR school was due primarily to large class sizes, irrelevant subjects, their general dislike of school, and to poor teacher attitudes. Young adults and adults were portrayed as opposite in their reasons for dissatisfaction with school. Perhaps teacher attitudes and unavailable courses were in the distant past and were remembered as a general dislike of school. However, the adults did not dislike school to the same extent that the young adults had more recently experienced. McLeary Smith (1995) found that drop-outs from an ABE program emulated the theory whereby a process originating during initial schooling persists in later educational settings because of unchanged circumstances and attitudes toward school. The ABE drop-outs were also younger on average than the ABE persisters.

Table 5

Student Responses to Past Education by Age and Gender

Question	Young Adult Agreement				Adult Agreement				Total	
	M	(%)	F	(%)	M	(%)	F	(%)	Ttl	(%)
Classes too big	7	(44)	8	(57)	8	(75)	10	(45)	33	(52)
Subjects not relevant	12	(75)	9	(64)	3	(25)	5	(23)	29	(45)
Disliked school	6	(38)	11	(79)	5	(42)	7	(32)	29	(45)
Poor teacher attitudes	10	(63)	7	(50)	6	(50)	5	(22)	28	(44)
Courses not available	6	(38)	1	(07)	3	(25)	8	(31)	18	(28)
Teachers don't care about students	7	(44)	5	(36)	2	(17)	4	(18)	18	(28)
Courses not in depth	5	(31)	4	(29)	2	(17)	5	(23)	16	(25)
Teachers don't care about me	5	(21)	3	(21)	4	(33)	2	(09)	14	(22)

The majority of students at Storefront School (Broadmead) recalled, in Table 6, an average of "C" obtained at their former schools, followed by "P" and "B". The young adults reported no failures nor incomplete courses which was checked further with school records. However, four adults reported failing grades in their last years of school. A higher number of young adults (9) reported "P's"

than did adults (6). These results were then compared to school records of past and present achievement.

Table 6

Student Recall of Achievement During Last Years of REGULAR Schooling

Average	Young Adult			Adult			Total
	M	F	Ttl	M	F	Ttl	
A -- 86 +	0	0	0	0	1	1	1
B -- 73-85	1	3	4	2	4	6	10
C -- 60-72	10	7	17	6	11	17	34
P -- 50-59	5	4	9	3	3	6	15
INC/Fail	0	0	0	1	3	4	4
Totals	16	14	30	12	22	34	64

One student who received the majority of her schooling at home did not have grades available to the school. Permission was granted by School District #63 for the student to enter into the graduation program with the stipulation that further advancement was to be based on grades earned. On comparing the young adults' results from the questionnaire with the school records (Table 7), no students had reported failing or incomplete grades while school records showed that nine students were in this category. Perhaps the students in each of the latter

two categories inflated their grades by one category. Such an explanation would match the results from the questionnaire and from the school records. Unfortunately for this portion of the study, adults were not required to submit previous grades in order to enter courses of their choice.

Table 7

Students' Average Grades by Age Based on School Records

	Past	Present	
Grades	Young Adults	Young Adults	Adults
A 86+	0	2	11
B 73-85	4	18	20
C 60-72	11	8	9
P 50-59	8	1	2
INC/Fail	9	4	0
Total	32	33	42

Generally, both adult and young adult students had similar reasons for leaving REGULAR school (Table 8). Where adults chose to leave upon completion of their program, young adults withdrew from their program. Further, young adults cited problems with teachers as influencing their decision to leave while adults indicated that poor marks were one reason for leaving. Males from

both groups stated that interference with their jobs aided their decision to leave, but adult males were more likely to state that financial reasons caused them to leave school. The females from both groups stated that poor grades led to their decision to leave school with the adult females more emphatic in this regard.

Table 8

Student Reasons for Leaving REGULAR School

Young Adults	Adults
Lack of interest/dislike/boredom	Completed requirements at that time
Withdrew	Lack of interest/dislike/boredom
Skipped classes and fell behind	Problems at home
Problems with teachers	Poor grades
Problems at home	Skipped classes and fell behind

Cognitive Style

The sample consisted of 75 students for the cognitive style preference study, of which 31 were males and 44 were females. Table 9 indicates the composition of the sample by age and gender. The sample was divided into one young adult (16-22) group and two adult groups for comparative purposes. This

division combined Cross' (1981) adult developmental phases into three groups rather than six groups for comparison purposes within the sample.

Table 9

Cognitive Style Sample of Students by Age and Gender

Age	Male	(%)	Female	(%)	Total	(%)
16-22	18	(55)	15	(46)	33	(100)
23-34	5	(25)	15	(75)	20	(100)
35-56	8	(36)	14	(64)	22	(100)
Totals	31	(41)	44	(59)	75	(100)

The best comparisons could be made between the young adult group and the adult group which had 33 and 42 members respectively where at least 30 cases were considered minimal (Borg & Gall, 1989). However, smaller sample sizes may yield more information than larger samples when a variety of quantitative and qualitative methods were used (Borg & Gall). Figure 1 indicates the general equivalence of males and females in the two adult age groups.

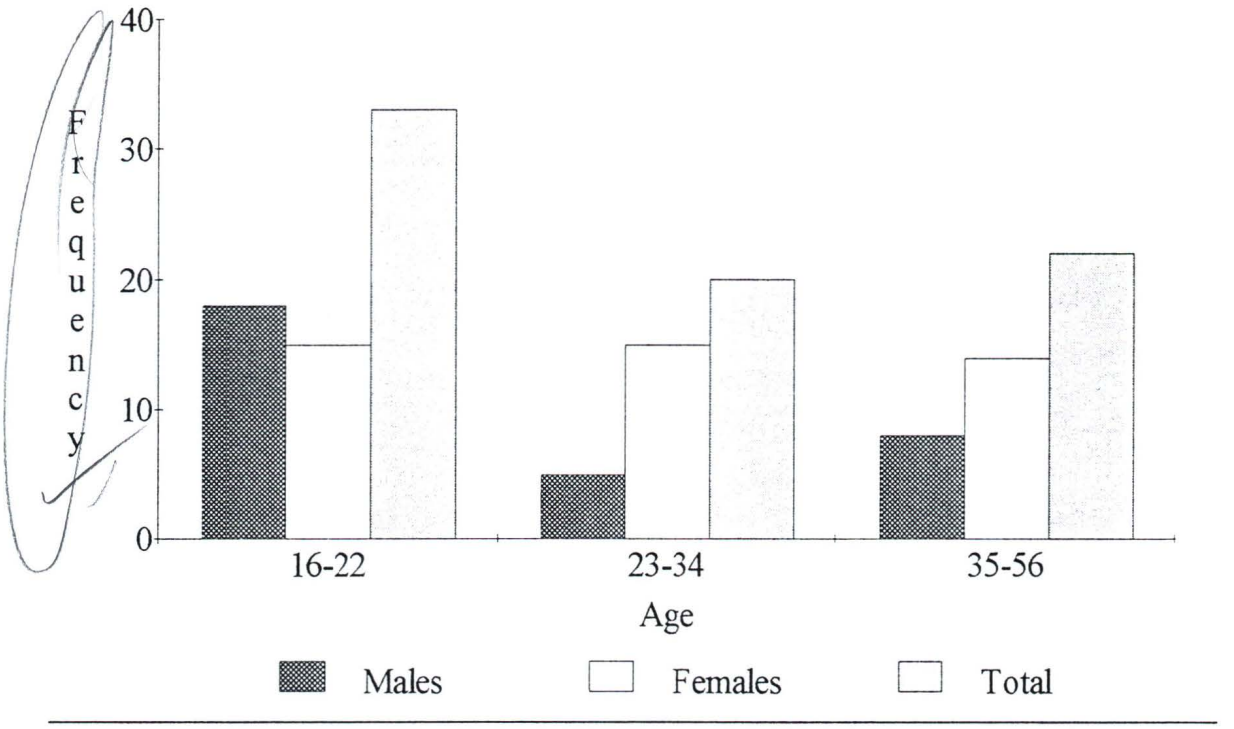

Figure 1. Number of students in the cognitive style sample by age and gender.

Frequency and Distribution of Cognitive Styles

Student scores of 27 or higher indicated that the student had a dominant preference for a particular style type--CS, AS, AR, CR. The possibility existed that a student could have none, one, two, or three dominant cognitive styles since the total score sum would be 100 (Table 10). For the rest of the study only the most dominant style will be recorded for each student.

In the interpretation of the data, a fifth style (bimodal--BI) was included where a student may have two or three equally dominant styles (Figure 2). The dominant cognitive style for the group was AR (31%) followed by CR (29%). The

other styles, including bimodal were almost equivalent but in total accounted for only 40 percent of the sample.

Table 10

Distribution of Dominant Cognitive Styles

	Number of Dominant Styles				
	0	1	2	3	Total
Frequency	2	26	46	1	75
Percent	3	35	61	1	100

Of the four cognitive styles, the males were dominant in the CR style (42%) while the females were dominant in the AR style (41%). The concrete styles were preferred by 65 percent of the males, while the females preferred the abstract styles (57%). Males (58%) and females (61%) favored the random styles in general when compared to the sequential styles.

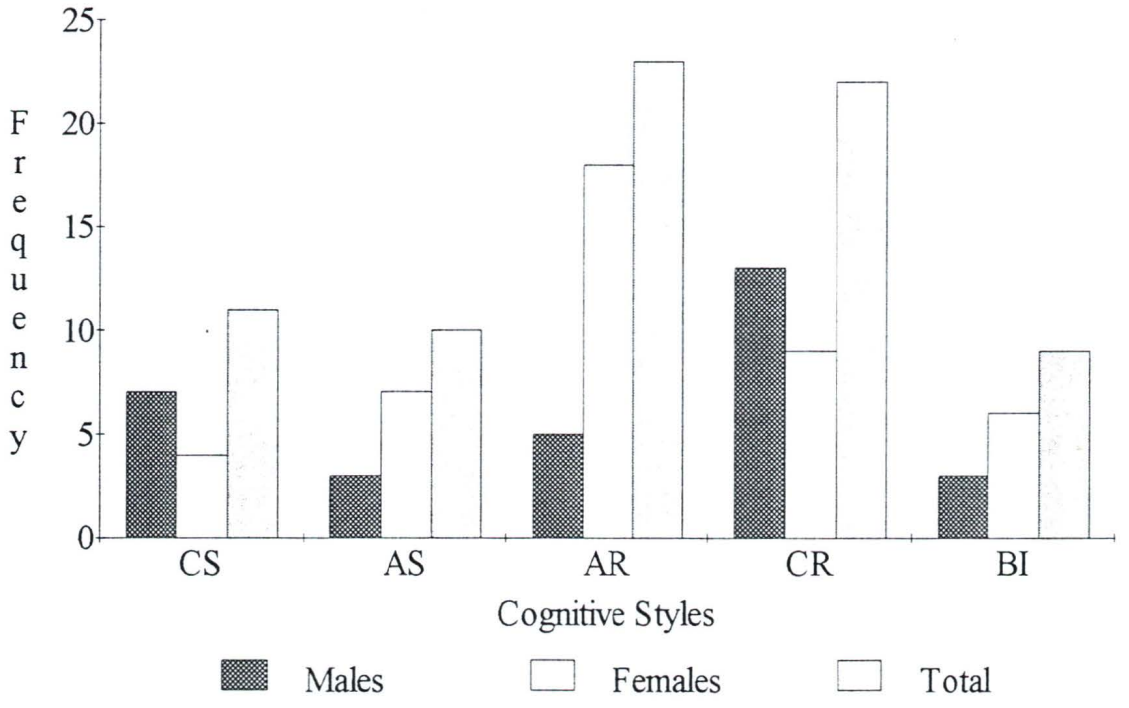

Figure 2. Cognitive style of students by gender.

When the student's most dominant style was considered rather than the comparison of the means of the four styles (Table 11), then young adults and adults were seen to be equally concrete and abstract. Where the adults had an equal preference for sequential and random styles (19, 18) the young adults preferred the random style almost exclusively (27, 2).

Table 11

Comparison of Most Dominant Cognitive Styles by Age Group and Gender

	Cognitive Style				
Age	CS	AS	AR	CR	BI
Young Adult (16-22) (n = 32, 43%)					
Males (n=17, 53%)					
Frequency	2	0	5	9	1
Row %	12	0	29	53	6
Females (n=15, 47%)					
Frequency	0	0	9	4	2
Row %	0	0	60	27	13
Adult (23-56) (n = 43, 57%)					
Males (n=14, 33%)					
Frequency	5	3	0	4	2
Row %	36	21	0	29	14
Females (n=29, 67%)					
Frequency	4	7	9	5	4
Row %	14	24	31	17	14
Total Sample	11	10	23	22	9

Significant Differences in Cognitive Styles

An ANOVA was performed to determine if there were any significant differences between young adults and adults, and genders within each group and between groups. In a comparison of young adults with adults, significant differences in choice of cognitive styles were apparent (Table 12). There was a significant difference between young adults and adults with the style CS at the $p < 0.05$ level, and with the styles AS, AR, and CR at the $p < 0.01$ level.

Table 12

Analysis of Variance Between Young Adults and Adults

With the Dependent Variable Cognitive Styles

Variable	Age Group	Mean	Std Dev	F	Sig of F
CS	Young Adult (n = 33)	21.94	4.86		
	Adult (n = 42)	24.45	5.67	5.431	0.023
AS	Young Adult (n = 33)	20.30	3.36		
	Adult (n = 42)	24.86	4.25	25.709	0.000
AR	Young Adult (n = 33)	28.76	4.61		
	Adult (n = 42)	26.07	4.50	12.552	0.001
CR	Young Adult (n = 33)	29.00	4.92		
	Adult (n = 42)	24.62	5.77	9.937	0.002

Figure 3 and Figure 4 indicate the relationships between the means of the cognitive styles of various age groups. Adults had a greater preference for the CS and AS cognitive styles when compared to the young adults, but they were quite straight-lined among all four cognitive styles. Young adults preferred AR and CR styles when compared to adults and within their own group. This might suggest a preference for random selection and processing of information.

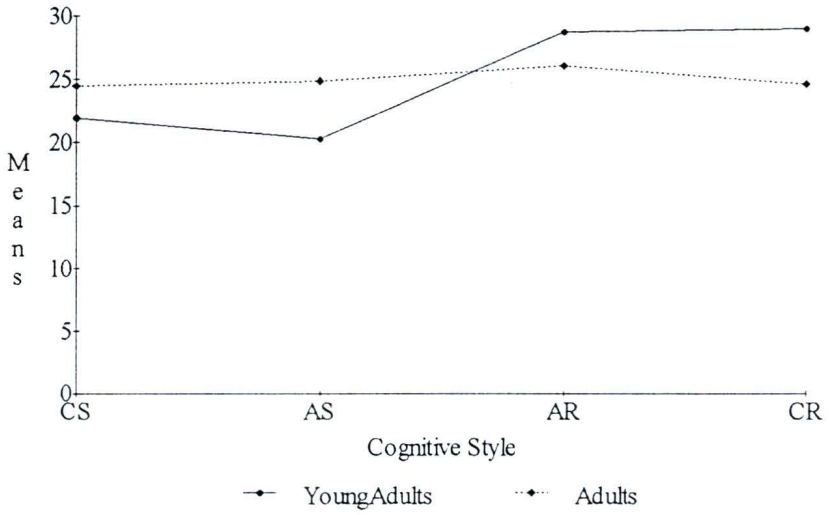

Figure 3. Comparison of young adults and adults by group scale means.

The ANOVA did not indicate any significant differences with cognitive styles based on gender within any of the age groups. However, there is a significant difference within the entire sample for the preference of the AR style, based on gender, at the 0.01 level (Table 13). Females had a greater preference for the AR style compared to males based on Figure 2 data.

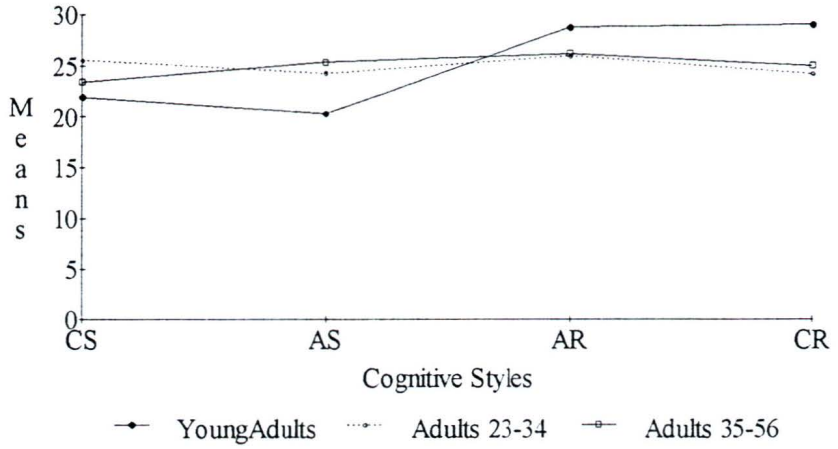

Figure 4. Comparison of cognitive styles among three age groups.

Table 13

Analysis of Variance on the Group for Cognitive Styles Based on Gender

Variable	Gender	Mean	Std Dev	F	Sig. of F
CS	Male (n = 31)	24.06	5.26		
	Female (n = 44)	22.84	5.57	2.271	0.136
AS	Male (n = 31)	22.61	4.15		
	Female (n = 44)	23.02	4.73	0.592	0.444
AR	Male (n = 31)	25.55	5.18		
	Female (n = 44)	28.45	3.99	13.694	0.000
CR	Male (n = 31)	27.77	5.42		
	Female (n = 44)	25.68	5.97	0.703	0.405

Computer-Assisted Learning

The demographic and computer-use questionnaire (Appendix B) was administered to the students to determine differences or relationships, based on certain student characteristics, among several variables. Since this questionnaire was administered subsequent to the Gregorc Style Delineator, fewer students were available to continue with the study (N = 64).

Correlations Within Computer-Assisted Learning

A MANOVA revealed no significant differences with the variables extensive computer expertise, Windows management, and computer expertise by age group nor by gender. No significant differences were found with positive nor negative computer learning experiences based on gender between age groups and within age groups.

WHICH VARIABLES?

The Pearson product-moment correlation coefficient, r, was used to determine whether variables were correlated to positive or negative learning aspects of computers. Table 14 shows that the variables of Windows management and extensive computer-use were positively correlated with the positive learning aspects at the 0.01 level. Computer expertise was positively correlated with the negative learning aspects at the 0.05 level.

Table 14

Correlation of Variables with Positive and

Negative Learning Aspects of Computers

Variables	Positive Learning	Negative Learning
Computer Expertise	0.216	0.315*
Windows Management	0.665**	0.142
Extensive Use	0.634**	0.159

** $p < 0.01$ * $p < 0.05$

If correlations existed between specified questions on the researcher's demographic and computer-use questionnaire (Appendix B) and the Adult Basic Education (ABE) questionnaire (Appendix H), then comparisons between students from the two samples could be made. The students in the ABE study used CAL in a different manner than the students in the present research and the former students used only one type of CAL system. A strong correlation existed between questions determined to indicate positive computer learning experiences on the researcher's questionnaire with all the questions found on the Adult Basic Education (ABE) questionnaire. Although some questions on the ABE questionnaire had a possible suggestion of negative computer learning they were still positively correlated to the researcher's questions (Table 15).

Table 15

Correlations Between Researcher and ABE Questionnaires

	ABE Positive	ABE Negative
Researcher Positive	0.716**	0.546**
Researcher Negative	0.135	0.313*

** $p < 0.01$ * $p < 0.05$

Cognitive Style and Use of CAL

A MANOVA was performed to determine whether the types of CAL (reference--low, reference--high, service applications, learning systems, and distance education) were used significantly more or less by gender and by age. References which were designated highly interactive were reported to be used at a significantly higher rate by females than by males at the 0.05 level. Young adults were reported to be at a significantly higher level of computer expertise than adults at the 0.01 level. Other significant differences by gender and age were not determined.

It was determined that a MANOVA would be the best method for comparing differences between the four cognitive styles and the five types of CAL for the 64 student participants. However, no significant differences were determined between cognitive style and type of CAL used. Yet, if the student's

most dominant cognitive style were used for comparison purposes rather than differences between the means of each category, then preferences of CAL types by cognitive style were evident (Table 16).

Student choice of CAL ranged from zero to five (Table 1) where the CAL system utilized by the majority of students was service application (Table 2). All of the cognitive styles, with the exception of CR, showed a first preference for service application (Table 16). Of the students choosing to use CAL, very minor differences existed in utilization by gender, by age, and by dominant cognitive style. Students with the CR style preferred to use low interactive reference CAL while students with the CS and BI styles shared that preference along with another CAL system.

There were 18 students (28%) who chose not to use CAL while completing their programs. Nine young adults (30%) and nine adults (26%) were in this group. Young adult males (31%) and females (32%) were equally represented while adult females (32%) nearly doubled the number of adult males (17%) who did not use CAL. BI and CR styles were indicative of the students who chose not to use CAL.

Table 16

Student Use of CAL Based on Most Dominant Cognitive Style

Cognitive Style	None	Reference Low	Reference High	Service Application	Learning Systems	Distance Education
CS n=10	2	5	2	5	3	1
% of n	(20)	(50)	(20)	(50)	(30)	(10)
AS n= 7	1	1	0	4	2	0
% of n	(14)	(14)	(0)	(57)	(29)	(0)
AR n=19	4	6	2	12	6	0
% of n	(21)	(32)	(11)	(63)	(32)	(0)
CR n=19	6	10	4	8	6	4
% of n	(32)	(53)	(21)	(42)	(32)	(21)
BI n= 9	5	4	2	4	3	2
% of n	(56)	(44)	(22)	(44)	(33)	(22)

Interviews

The interview sample consisted of nine young adults and 11 adults. This compares to the Delineator sample composition of 33 young adults and 42 adults and to the demographic and computer-use sample composition of 30 young adults

and 34 adults. The age group composition was similar for each of the samples as was the gender composition (Table 17).

Table 17

Comparison of Cognitive Style for the

Interview, Delineator, and Demographic Samples

	Interview Sample		Delineator Sample		Demographic Sample	
Style	Students	(%)	Students	(%)	Students	(%)
CS	4	20	11	15	10	16
AS	1	5	10	13	7	11
AR	8	40	23	31	19	30
CR	6	30	22	29	19	30
BI	1	5	9	12	9	14
Total	20	100	75	100	64	101

Cognitive Style

Before students were asked questions regarding their most dominant cognitive style (Appendix G), the researcher reviewed pertinent information with them about that style as suggested by Gregorc (1982). The majority of students who were interviewed (85%) agreed that their most dominant style, as determined by the Gregorc Style Delineator, best described them. Five questions (one for

each style) were taken from Butler's Style Channel Questionnaire and were used during the interview to corroborate the students assertions. From student responses to these questions it was determined that 16 answers (75%) corresponded to at least the student's second dominant style, eight answers (40%) matched the most dominant style, while four responses (25%) indicated no correspondence. The results gathered from this part of the interview enabled the researcher to more confidently compare the student's most dominant cognitive style to CAL utilization, without entirely relying on the significant differences, or lack of, as determined from the statistical analyses.

Second-Chance Environment

Students were asked several questions regarding their choice of educational setting in order to determine a basis for comparing this study with others and to further elaborate on questionnaire responses. Answers to questions about student choice of an open-ended learning environment rather than a directed-learning classroom resulted in students' preferences for:

self-pacing	12 (60%)
flexibility of hours/convenience	10 (50%)
less pressure/fewer deadlines	6 (30%)
receiving help quickly	4 (20%)

Nine students (45%) indicated that the Storefront School (Broadmead) program was a second-chance for them, otherwise, they wouldn't attend school. Of the remainder, eight students (40%) stated that this was a continuation of their

education while three students (15%) indicated that the program represented a combination of second-chance and a continuance of their education.

Some discussion ensued where the student was asked, to the best of their recollection and using their present knowledge, to list and compare the resources at both schools. A majority of students (17, 85%) stated that resources at the Storefront School (Broadmead) helped them learn more and achieve higher than they would in a regular classroom. The helpful resources were:

computers	12 (60%)
setting/environment	7 (35%)
information/variety	6 (30%)
teacher access/help	4 (20%)

When students were questioned about which aspects of a regular classroom would better suit them, they responded:

none	12 (60%)
completion timelines	4 (20%)
verbal instruction	2 (10%)
group work	1 (5%)

A major consideration for the researcher was the students' attitudes toward CAL. The provision of the proper quantity and blend of CAL to meet the various learning styles of students was emphasized in the literature review. Of the students interviewed, 12 students (60%) were comfortable with the use of computers, six students (30%) had concerns about computer operation, while two students (10%) did not use them. When asked whether computers were preferred in completing coursework satisfactorily, eight students (40%) agreed, seven

students (35%) stated they worked better without CAL, while five students (25%) preferred a combination of CAL and print materials. However, 16 students (85%) declared that the best information was not found in books.

A mixture of responses resulted when students were asked whether the variety of CAL enabled the students to improve their learning or to find new ways of learning:

quicker/easier	8 (40%)
prefer working with people	6 (30%)
adapting new skills/not new method	4(20%)
adds variety to learning	2 (10%)

The above answers indicated that rather than finding new ways of learning, students were improving their present repertoire of skills and were saving time (16, 80%) by using a valuable tool (13, 65%).

Learning and Computers

In order to compare students from this research with students from other studies, questions were asked to elicit responses about past and present learning experiences (Table 18). The majority of students stated that their role as a student had changed:

more responsible for their own learning	11 (55%)
using more effort now	7 (35%)
want to be here	4 (20%)
doing it myself/for myself	3 (15%)

Table 18

Past Positive and Negative Learning Experiences

Positive Experiences		Negative Experiences	
Teacher attitudes	6 (30%)	Teacher problems	7 (35%)
None	5 (25%)	Lack of help	3 (15%)
Success	3 (15%)	Lack of personal interest	2 (10%)
Offspring's experiences	2 (10%)		

As a group, 17 (85%) of the students were meeting their own expectations while three (15%) were considering parental or institutional expectations. Age was a factor (13, 65%) which affected learning style and students who agreed with this statement indicated that they were more mature, were not afraid of accepting opportunities, and were more focused. Young adults were ambivalent on this point and some indicated that other factors were more influential on learning styles, such as the environment (setting), adapting to changes, and the wider variety of life experiences. Although 12 students (60%) mentioned that their present life situation did not affect their learning style, some stated the following concerns:

were out of practice	2 (10%)
required flexibility	2 (10%)
feared being left behind	2 (10%)

Technology was considered by 12 students (60%) to affect their learning style by expanding their thinking, by helping them to explore more, and by making learning easier and quicker. Of the six students (30%) who did not consider this as a factor affecting their learning style, their comments included the fact that technology was only an adaptation to the work environment and it assisted with their work in a faster, easier way. Eight students (40%) were not intimidated by computers, while the remainder of the sample were intimidated somewhat (5, 30%), were not a computer user (4, 20%), or were only intimidated at the start (3, 15%). In their present situation at the Storefront School (Broadmead), 19 students (95%) were satisfied with the availability of computers and 15 students (75%) were satisfied with the instruction given on computer use.

Summary

Data obtained from the demographics, computer-use and learning questionnaire, supported by the researcher's journal, was used to describe the variety of CAL used by students in the Storefront (Broadmead) School. The majority of students used two or more types of CAL but 28% of the students chose not to use any. The most popular systems were service applications and low interactive reference.

Students provided information on parents' occupations, past educational experiences, recall of grades, and reasons for leaving school. Generally, the data was similar to that of drop-outs described in the literature. Some data was found

lacking, such as school reports of the adults' past grades, and this led to a suggestion for further research.

Data on student cognitive styles was obtained from several sources and the similarity of results from the various sources enabled the researcher to choose the most dominant style to search for relationships between cognitive style and choice of CAL. The most dominant style for the group was the AR style and this was significantly chosen by female students. Although young adults were significantly different from adults on all four scales (CS, AS, AR, CR), both age groups were equally abstract and concrete. While adults as a group were equally sequential and random, the young adults were overwhelmingly random.

Evidence was not found to support student choices of CAL based on cognitive style. Discussion during the interviews indicated a strong preference for CAL based on relevance to the courses rather than displaying any link to the student's cognitive style.

CHAPTER 5: DISCUSSION AND INTERPRETATION

The present research findings indicated both similarities and differences with other studies and with statements from the literature. Several inferences were drawn from the comparisons and related to theories and suggestions found in the literature.

Demographics

Several studies (Price Waterhouse, 1990; King, Warren, Michalski & Peart, 1988; Sullivan, 1988; Radwanski, 1987) were recently conducted in Ontario regarding students' reasons for dropping out of school and how to retain students. Wessing (1991) reported on student leavers and their re-entry to regular classrooms after receiving guidance and success through alternative education. The present study made comparisons with these studies based on three common elements found within the studies: student reasons for dissatisfaction with school, reasons for leaving school, and achievement. This study indicated that large class sizes (52%) , irrelevant subjects (45%), general dislike of school (45%), and poor teacher attitudes (44%) were the main reasons for dissatisfaction with schools. King et al also reported lack of relevance of course and teacher attitudes, while Sullivan included skipping classes/falling behind as major reasons for disliking school. Radwanski indicated that 45% of Ontario drop-outs cited school-related reasons such as general dislike , lack of interest and boredom as their major

dissatisfaction with school. This information was corroborated with information provided from surveys of teachers and parents.

The Price Waterhouse (1990) and the Radwanski (1987) studies suggested that a gradual withdrawal occurs during the transition to high school and was corroborated by McLeary Smith (1995). Difficulties making friends or difficulties becoming involved in school activities contributed to the withdrawal process which led to students dropping out of school. The present study reported boredom, skipping classes and falling behind, and problems at home as the main reasons for leaving school. Wessing (1991) listed similar results while King et al (1988) reported getting a job in addition to the above reasons. Radwanski (1987) reported that many drop-outs were from lower socio-economic status households where early learning experiences were more limited and where educational expectations were less emphasized. He suggested work-related reasons for leaving school were inversely related to the weak holding power of the current functions of high school. Personal or family reasons for leaving school were related to the less impersonal school environment.

Apparently, influences of family socio-economic background was a more powerful factor in school leaving than a student's innate mental abilities (Radwanski, 1987). The present study (Table 3) indicated that fathers were professional/technical/cultural (33%) or manager/owner (27%) compared to Radwanski's survey of 22% for both groups of fathers. This study indicated a

lack of fathers in the manufacturing sector while Radwanski's survey included 51% of fathers in the medium to low level production sector. The former situation was probably due to the low percentage of manufacturing/fishing/logging opportunities on South Vancouver Island. The present study indicated that 47% and 23% of the students intended to enter profession/technical/cultural or manager/owner careers. Thus the present sample does not compare to the other studies in matters related to drop-outs which were attributed to socio-economic reasons.

Some success was reported by several studies in student re-entry into education but barriers still existed. McLeary Smith (1995) reported that reasons for leaving school suggested by high school drop-outs persisted when the same students dropped out of ABE programs. Radwanski (1987) reported that only 18% of drop-outs returned to school, tended to be concrete rather than abstract thinkers, had low levels of self-esteem and self-confidence, and felt alienated. In contrast, the present study reported equal representation among abstract and concrete styles within young adult and adult groups. The Price Waterhouse (1990) study and Wessing (1991) suggested that re-entry of drop-outs be accommodated through alternative programs similar to the successful employment-training programs. A supported work experience within a program helped prepare the students in applying for future jobs. Self-pacing was important during re-entry where short-term courses enabled students to progress at their own pace. Wessing (1991)

reported that 25% of students cited lack of flexibility in scheduling as detrimental to re-entry into regular classrooms after successful preparation at an alternative school. Sullivan (1988) suggested that the strong feeling of not wanting to return to school became a barrier to completing high school, although he reported that 59% of drop-outs had taken some courses in technical, high school, or correspondence settings.

A final comparison was made between the present study and Sullivan's study (1988) regarding achievement in drop-outs. He reported that 53% of the drop-outs had grades higher than C while the present study reported 28% of the sample with grades higher than C. Self-reporting led to one grade level higher than that determined from records of young adults in the present study and this may be true of the other studies. However, the Sullivan study was representative of a provincial population where the present study is not. Further studies on a provincial basis would be suggested to determine the significance of grades of drop-outs when compared to the present sample.

Cognitive Styles and Age-Related Learning

Tennant's review of 1990 indicated that intellectual functioning remains relatively stable with age. There would be simply a progressive move from fluid to crystallized intelligence. From the teenage years onward, fluid intelligence (complex reasoning and memory) decreases while crystallized intelligence (information storage, verbal comprehension, and numerical reasoning) increases.

In the broader sense of adaptability adult learners move from the basic cognitive operations--mechanics of intelligence--to wisdom and understanding--the pragmatics of intelligence (Tennant).

Results from the present study (Figure 3 and Figure 4), based on statistical comparisons, indicated a distribution of random styles among young adults in the accessing and processing of information (cognitive style) while adults from both age groups (23-34, 35-56) showed a more balanced distribution among the four cognitive styles. These findings would support Tennant's view that mature adult cognition is reflected by the ability to fit abstract thinking into the concrete limitations of daily living.

By using only the students' most dominant cognitive style, comparisons were made with other studies. O'Brien (1994) reported a study which used the Learning Style Inventory (Kolb, 1976) and which indicated that high school students were more concrete and substantially less abstract in cognitive styles when compared to adults. Results from the present study differed from the previous study since results (Table 11) indicated that young adults (16-22) were equally concrete (15) and abstract (14). This was similar to the adults who were equally concrete (18) and abstract (19). Where the former study stated that female high school students were more concrete in styles than males, this study indicated that males were more concrete (11, 65%) than the females (4, 27%).

Further studies cited by O'Brien (1994) occurred at the community college or university levels. One study reported that learning style type differed significantly in relation to age but not in relation to gender. The present study corroborated these findings. Significant differences (Table 12) existed between young adults (16-22) and adults (23-56) for the four style types. The preference of female students for the AR style (41%), significant in Table 13, was also comparable to previous university studies, although no other comparisons were apparent. An earlier study by O'Brien (1991) indicated that males exhibited stronger preferences for the AS and CR styles than female students. The present study indicated that males preferred CR (42%) and AS (10%) compared to the CR (20%) and AS (16%) of the females which was not considered significant (Table 13).

Not Drop-outs

O'Brien's study of 405 high school students reported a cognitive style distribution in order of frequency: AR (40%), CR (24%), CS (19%), AS (8%), and BI (9%). The present study, at the Storefront School (Broadmead), reported a similar order of distribution for 75 young adult and adult students: AR (31%), CR (29%), CS (15%), AS (13 %), and BI (12%). However, a notable difference became apparent (Table 19) on comparison of O'Brien's high school students with this study's young adult group (16-22) and adult group (23-56). The lack of preference for sequential styles by young adults and the balanced preference of styles within the adult group in the present study is very apparent when compared

to O'Brien's high school group. The overall distribution of the two samples by gender were similar within one percent, but the ratio of males to females preferring concrete to abstract styles in the young adult group was reversed compared to O'Brien's group and the adult group. Only slight differences existed in the present study between the choice of various combinations of age groupings within the young adults to match high school-aged students.

Table 19

Comparison of Cognitive Styles Among Selected Study Age Groups

Study Group	CS	AS	AR	CR	BI
O'Brien (1994)	19%	8%	40%	24%	9%
Present--Young Adult	6%	0%	44%	41%	9%
Present--Adult	21%	23%	21%	21%	14%

Similar research was performed by Kindrachuk (1992) with 167 students in an alternate school. This setting would more closely resemble that of the present study. However, Kindrachuk used Butler's student guide to learning styles rather than Gregorc's Style Delineator. This choice could reflect the classroom delivery model of learning as opposed to the open-ended learning model employed in the present study. Kindrachuk's study indicated a strong preference for the AR (42%) and CR (42%) styles with very few students choosing the AS (6%) style.

Percentages were interpreted by the present researcher from available graphs. Results from Table 19 indicated a close similarity between the two studies for young adults.

Cognitive Styles and Computer-Assisted Learning (CAL)

An analysis of the use of CAL in Adult Basic Education (ABE) was reported in the literature (Thomas & Buck, 1994). Similarities existed in the setting between the education centres mentioned and the Storefront School (Broadmead). Hours of attendance ranged from a mandatory 25-hour week to a choice of hours, dependent on convenience for the student. Although most ABE centres offered employment preparation courses, several enabled students to obtain grade 10 equivalency, GED or high school equivalency, or grade 11 and 12 courses. College sites were similar to the present study site in their use of CAL to supplement class or group work. The present research site offered courses for grade 10 equivalency, GED or high school equivalency, and both adult and high school diplomas. The main emphasis at this site was to enable young adults and adults to graduate with high school diplomas. The age of students in both studies ranged from 16 years to senior citizen due to the nature of the open door policy.

Differences occurred between the present site and the ABE locations. While the Storefront School (Broadmead) is sponsored solely by School District 63, the majority of the other sites were sponsored by government agencies. Students in the present study could choose to use or not to use any or all of five

varieties of CAL, whereas students at the other sites were limited during the study to one type of CAL and many of these sites required the students to use the CAL exclusively. Although special needs students were not a priority at the present research site, over 70% of the ABE sites had some time dedicated to this group of learners.

The ABE study (Thomas & Buck, 1994) analyzed student responses based on 46 interviews with students working on one of four CAL systems. Each CAL system was similar to the PLATO learning system mentioned in the present study. Females represented 63% of the students interviewed compared to 56% of the sample who participated in the CAL section of the present study. The ABE study included 24% young adults (18-25), whereas the present study had 47% young adult (16-22) participants. Levels at which the students in both studies were working were distinctly different with the ABE study indicating 23 (50%) and the present study showing 10 (16%) at the non-graduation level.

Several questions (Appendix H; 2, 3, 5, 7, 8) were answered similarly to the ABE study by a majority of the students but the present study included a significant number of "Don't Know"--a mean of 39%. More than 50% of the students agreed that using a computer for learning:

is easy	53%
allows me to learn at own pace	69%
is an efficient use of time	61%
increases interest in subjects	52%
increases use in everyday life	55%

is NOT slower than other methods >50%

The other questions were responded to between the 33% to 50% range.

The ABE study reported that the highest level of agreement was with CAL used at the fundamental ABE level. The agreement level decreased with the students who used the higher end systems. Perhaps the drop off of agreement level with CAL used in the ABE study resulted from the lack of provision for a wider variety of CAL which would allow for learners of varying styles to successfully and gainfully employ them. Although some reporting of word-processing was included in the ABE study, the focus was on a comparison of CAL learning systems.

In the present study (Table 2) , 19 (30%) of the students were using CAL for improving mathematics, grammar, and typing skills while the majority of students (33, 52%) used service application CAL systems such as word-processing, dataprocessing, and accounting which enabled these students to perform at a higher level in their graduation level courses. Although 67% of the computer-users (Table 1) preferred one or two types of CAL, 30% of the users required three or four types of CAL to complete coursework.

While the ABE study reported that 58% of the students were nervous while using computers at the start, 93% of the students indicated that computers are easy for learning. The present study reported lower results of 28% and 53% to these statements but these findings are not surprising when the 28% of the nonusers

were considered. Also, the ABE study dealt with, for comparison purposes, students who completed their learning assignments by using CAL.

Other studies (Fahy, 1992; Foshay, 1994) found larger effects from CAL experiments at the college and adult levels than at elementary and secondary school levels. Further findings were that CAL can be four times as effective as traditional remedial instruction, prepared participants for future computer-related jobs, and gave people an incentive to learn. CAL was not found to stifle the creative process, was not dehumanizing, and did not foster antisocial behaviour. However, the greatest gains occurred when CAL was integrated thoughtfully to supplement and complement existing courses (Foshay).

In recruiting and retaining learners for literacy programs, the studies suggested that an advantage for the program was to incorporate technology. The present study showed that questions on Windows manipulation (Appendix B; 10, 11, 14, 19) and on extensive computer-use (Appendix B; 12, 16, 17) were strongly correlated to the positive aspects of learning (Appendix B; 20, 22, 23, 26, 27, 28). On the other hand, the students' perceived computer expertise (Appendix B; 9, 13, 15, 18, 21) was correlated with the negative aspects of learning (Appendix B; 24, 25, 29) where students preferred traditional methods of teaching and standard course materials. This suggests that the more the students used CAL the more benefits that were seen, but the lower the students' perception of their computer expertise, then the fewer benefits that were seen. A significant difference toward

positive or negative aspects of learning was not indicated by age group nor by gender.

Data based on the qualitative approach, yet supported by evidence from secondary testing (Butler's style channel questionnaire, abbreviated) and from interviews, enhanced the results of the study obtained through quantitative methods. Significant differences at the $p < 0.05$ level were found in the choice of highly interactive references between male and female students, where female students had the greater preference. Young adults were perceived to be significantly higher in computer expertise than adults at the $p < 0.01$ level. No other differences appeared significant within the sample.

However, by using the students' most dominant cognitive style, several other differences were apparent. It was noted that of those students not using CAL, young adults were equally represented while adult females declined the use of computers at double the rate of adult males. The most obvious difference in choice of CAL by style was in the lack of use of any references by AS type students. Students with BI (56%) and CR (32%) styles preferred to work traditionally with standard course materials. CAL types which were designated as learning systems (PLATO, typing) were preferred by 29% to 33% of all cognitive styles which represented 20 students (31%) of the sample. Apparently, given the choice, students sought CAL which served their needs the most, independent of cognitive style.

Foshay (1994) reported a 10% learning gain with half the instructional time for drop-out students using PLATO. The present study indicated an increase of at least one grade level where 88% of the young adults who were previously at or below C were now reduced to 39% at or below a C. This increase could be due to the self-paced environment, and a more receptive and flexible environment (Fahy, 1992).

The use of multiple systems of CAL may more accurately address the participants' needs and interests (McCallister et al, 1988; Fahy, 1992). This would also free instructors to assist learners in choosing from among the learning options available. CAL systems similar to PLATO, with adult content and design, were effective learning tools for undereducated adults while students with higher reading and math skill levels (at program entry) learned faster through utilizing CAL (McCallister et al). The present study reported 72% of the students using one or more types of CAL. Results of the interviews indicated that the variety of CAL provided for student use improved their present repertoire of skills and saved them time (80%). The availability of CAL and the provision of adequate computer instruction by the instructors was cited by 95% and 75% of the students respectively. This was further emphasized by the majority of interviewees (85%) when they stated that the school's resources helped them learn more and achieve higher than they would in a regular classroom.

Dee-Lucas and Larkin (1995) suggested that electronic texts (encyclopedias) with interactive overviews (navigation systems) provided some learning advantages for students who wanted general familiarity with subject matter. Another advantage was the positive effects on incidental memory and breadth of recall for the text. Disadvantages were fragmentation of the text content when no specific learning goals were evident. Support for text integration was required and minimally structured overviews would be appropriate only after students had specific tasks to guide their learning. The present study indicated some support for the learning advantages presented by the ease of manipulating CAL while searching for material for projects. CAL such as Encarta 95 were used by 42% of the computer-users while the internet connections were used by only 11%. However, the Netscape Navigator, especially with its bookmark quality, has enabled easy access for those students who have recently attempted internet searches. Earlier versions of internet access required much patience, trial and error, and repetition on the parts of both students and instructors. Further research in this area would be required to clarify any advantages or disadvantages of interactive overviews.

The virtual textbook (Siegel & Sousa, 1994) was proposed to empower students as effective and creative learners, to move students beyond content mastery to information seeking and problem-solving skills. De Bruijn (1993)

proposed that a cognitive apprenticeship program corresponding to theories of adult education would include:

> -specific tasks which could be subdivided into substeps,
> -tasks from various contexts which could enable decontextualization,
> -subtasks represented schematically.

He reported results of research which concerned the learning styles of adults who work with computers in their daily lives. The females had a stronger need for concrete experience and active experimentation, while males required abstract conceptualization and active experimentation. The present study (Table 11) indicated that adult males preferred concrete styles (CR, CS, 65%) moreso than the adult females (31%). However, results from the student interviews indicated a strong perception (85%) of finding new ways of learning and of improving their present repertoire of skills which precluded any cognitive style preference.

Hansen, Laursen, and Aarkrog (1993) attempted to apply the ideals of general and liberal education to computer-training programs. Results indicated that 94% of the participants expressed neutral or optimistic attitudes toward computer-use, and that participants in the longer courses and in courses more aligned with job expectations reported the most changes in behaviour at work. The present study reported that 72% of the students chose to use CAL (Table 1) and of those using CAL, 57% chose to use two or more types of CAL systems. The highest use was in the service application of CAL (52%) which would relate more to the workplace. Technology was considered to affect their learning style

by 60% of the student interview sample. Expanded thinking, exploration, and ease and quickness of computer-use were cited as major reasons for responses by this group. Another 30% of the interviewees suggested that although their learning style was not affected by technology, they would consider computer-use to be an adaptation to the work environment and would assist them with their work in a quicker, more efficient manner. Although the present study indicated a range of neutral or positive attitudes toward computer-use (60% to 72%) depending on the question posed during the interview, the results were not as high as in the Hansen et al study. Similar results were obtained when comparing changes in behaviour to computer-use if that use was more aligned to the work performed. This was also indicated by the non-users.

Ease of use was cited by several researchers (Dee-Lucas & Larkin, 1995; Hannafin et al, 1994; Foshay, 1994; Fahy, 1992) as fundamental to student acceptance of computer-use as a valuable tool. The present study reported that 60% of the interviewees were comfortable using CAL after a brief training period. A further 30% of the students interviewed desired more specific training to gain a greater variety of computer expertise--manipulation between various disc drives and the functions of Windows 3.1.

Summary

The student sample has been thoroughly described in order to make comparisons with age groups and gender within the study and with other studies.

Learning styles, specifically cognitive styles, were determined for the sample and related to the sample's use of CAL and were compared with samples from other studies.

Demographics and the Second-Chance Environment

Student leavers or drop-outs were described by King et al (1988), Price Waterhouse (1990), Radwanski (1987), and Sullivan (1988) according to socio-economic background, achievement, dissatisfaction with school, and reasons for leaving school. The present study indicated similarities with the other samples in all but the socio-economic factor. Differences may have resulted from the dissimilarity between the economic regions in which the studies were conducted and with the broader population sampled in the other studies.

Student re-entry into schooling was reported by Wessing (1991) and Radwanski (1987) to require self-pacing and flexibility. The present study concurred with this statement but differed somewhat with Radwanski's reporting that the majority of these students were concrete thinkers. While the present study indicated that both age groups showed equality between concrete and abstract information reception and processing, males were more concrete and females were more abstract.

Comparisons with adult basic education centres (Thomas & Buck, 1994) indicated differences in the availability of CAL and the emphasis on level and delivery of learning, but showed similarities in age groups. Another alternative

school reported similarities in age to the present study's young adult population, but indicated differences in the delivery of the learning--directed versus open-ended learning.

Cognitive Styles and Second-Chance Students

An attempt was made to determine whether significant differences existed between the cognitive styles displayed by young adults and by adults. Findings concurred with current adult learning theories (Tennant, 1990) where mature adult cognition indicates both flexibility and adaptation to use abstract thinking within concrete contextual settings. The present study reported that young adults (85%) chose random styles (CR, AR) in receiving and processing information, even though they were equally distributed between abstract (AR, AS) and concrete (CR, CS) cognitive styles. This finding was significantly different from the results obtained for adults statistically, on comparisons of the differences of means for each cognitive style between age groups, and when comparing only the most dominant style of each student. The adults within their age group were equally abstract and concrete as well as equally random and sequential. Life experiences, comprehension and reasoning were suggested in the literature as more dominant features of mature adults. The findings were similar whether the data was statistically compared (Figures 1 & 2) or qualitatively described using the most dominant cognitive styles reported from the interview, Delineator, and demographic samples (Table 17).

Comparisons with other studies, using secondary school samples, alternative school samples, and college or university level samples revealed similarities and differences between young adult students, and between young adults and adults. The present study showed small differences in cognitive style preferences while attempting to select the appropriate ages for the young adult group. These results prompted the researcher to select the 16-22 age range that corresponded to one of the adult stages of growth (Cross, 1981). Similarities were found in the distribution of cognitive styles between O'Brien's (1994) sample of high school students and the present study's total sample of young adult and adult students--AR, CR, CS, AS, BI. O'Brien reported similar results with the present study where learning style differed significantly in relation to age (Table 19) but not in relation to gender. Females in both groups preferred the AR cognitive style while males exhibited stronger preferences for the AS and CR styles.

Differences occurred between the present study and those reported by O'Brien (1994) when the young adults were compared to other young adults. While O'Brien indicated that typical high school students were more concrete and less abstract than adults, the present study showed that both age groups were equally abstract and concrete. A gender difference became apparent between the young adults in the two studies where the preferences of abstract and concrete styles was reversed. However, the present study produced cognitive style results very similar to the findings in another alternate school setting (Kindrachuk, 1992).

Young adults in the education environment chose AR and CR styles almost exclusively (84%) to the exclusion of AS (6%). These findings could be interpreted to be specific to second-chance environments where young adults as a group display equally abstract and concrete cognitive styles that are limited to random rather than sequential preferences of receiving and processing information.

Cognitive Styles and Computer-Assisted Learning

The present study was compared with the specific studies on users of CAL (Thomas & Buck, 1994) and with a broader range and interpretation of studies (De Bruijn, 1993; Dee-Lucas & Larkin, 1995; Fahy, 1992; Foshay, 1994; Hansen et al, 1993; McCallister et al, 1988; Siegel & Sousa, 1994;). Although the ABE study (Thomas & Buck) indicated differences in educational emphasis, choice and use of CAL, levels of learning and representation of age groups with the present study, both studies shared similarities in responses when relating computer-use to positive learning situations and to initial intimidation with computers. However, the present study reported further results:

> young adults used computers significantly more than adults,
> adult females were twice as likely not to use CAL than males,
> young adults were equal by gender in non-use of CAL,
> and AS style students reported little use of any CAL references.

Results from the present study compared favorably with the comprehensive interpretation of studies (Fahy, 1992; Foshay, 1994) by reporting that more benefits accrued to the students who indicated the broader use of CAL. Fewer

benefits were seen by students who perceived themselves as having low computer expertise. Given choices of various CAL systems, students sought those which served their needs the most, independent of cognitive style. Foshay and Fahy reported learning gains for drop-out students who used CAL learning systems such as PLATO, but they attributed this gain to the more receptive and flexible learning environment as well as to the CAL. The present study indicated an increase of one grade level for young adult students. With 30% of the sample reported as non-users of CAL the increase in grades could be attributed to the open-ended learning environment as well as to the variety of CAL systems. However, observations suggest that the variety of CAL contributed positively toward the students' achievement and learning experiences. Of the students interviewed, 85% stated that the school's resources helped them learn more and achieve higher than they would in a regular school. A further 65% of the students reported that CAL was useful in helping them complete their courses satisfactorily.

While most of the other research involving adults indicated a preference by adult males for abstract conceptualization and females for concrete experience, the present study reported the reverse. Generally, the study agreed with the theories and studies presented in the literature where changes in behaviour toward computer-use would occur if that use was more aligned to the work performed and to the ease of use. The present study reported that this statement was indicative of both computer-users and non-users who were interviewed. Further, the interviews

revealed a strong student perception of finding new ways of learning and of improving skills, regardless of their cognitive style preferences. The only significant differences between cognitive styles and CAL used which were reported were the females' preference for highly interactive references and with the young adults greater computer expertise.

CHAPTER 6: CONCLUSION

Several problems related to learning styles, technologies, and learning environments have been mentioned in the literature. This study attempted to explore several of these concerns. The emergence of new technologies and other changes within the learning environment demand a careful balance between inclusion of the proper technology with the variety of learning styles displayed by students. Difficulties with grouping young adults and adults together in the same environment might arise due to differences in their patterns of learning and development. Suggestions for facilitation of independent learning might be implemented through the inclusion of computer-assisted learning (CAL) that addresses the needs of a group of students which exhibits a wide variety of learning styles. Since computers and software represent a means of receiving and processing information, research on student cognitive styles has provided a plausible method of acquiring more understanding about the relationships between students in a self-paced second-chance environment and with their choices of CAL.

Interpretations of the Findings

Considerable effort was spent on acquiring and analyzing data about student demographics within the alternative school involved in this study. The information provided did enable the researcher to determine the possibility of

making valid comparisons between the students in this and other studies. The age group, young adults, was most comparable with another alternative school by age and by results, but not by learning methods--the present study portrayed an open-ended learning environment while the other study indicated a teacher-delivery setting. This would suggest that the setting and the teaching personnel might be factors that attract students who exhibit the more random cognitive styles (CR, AR). The more probable explanation would be that this type of student would be better suited to an open-ended learning environment initially, rather than a teacher-directed model. Several studies on the re-entry of students into schools indicated a student desire for self-pacing and flexibility.

The students in the present study were similar to Ontario school drop-outs in all the aspects compared except for socio-economic factors and the dominance of concrete thinkers in the other samples. The present study was conducted in a region that lacked a large manufacturing presence and where only the males displayed the more concrete (CR, CS) cognitive styles. Generally the adult and young adult students would be representative of school-drop-outs portrayed in the literature.

Several differences existed between the present study's student sample and the ABE student sample. However, similar results with the studies suggest that computer-use led to positive learning situations and that the broader use of CAL would result in more benefits in learning for the students. This statement would

support interpretations by other researchers who performed comprehensive literature reviews.

The dominant cognitive style in the self-paced second-chance environment of the Storefront School (Broadmead) was the abstract random (AR) style and this style was more significantly distributed among females than males within the total sample. Although the concrete random (CR) style was associated more with males, this was not statistically significant. No significant gender differences were apparent within the age groups. Initial analysis indicated no differences between the present sample as a group compared to a large high school sample. However, when the present student sample was divided into young adult and adult groups, the results were favorable to studies that showed significant differences in cognitive style by age. The equal distribution of the cognitive styles among the adults reflected suggestions in the literature that adults have life experiences, comprehension and reasoning that enable them to be flexible and adapt abstract thinking within concrete contextual settings. Although the concrete and abstract styles were equally distributed among young adults, a feature shared with the adults, the random styles would be found to a greater extent than sequential styles for most learning situations. Results from this study indicated that young adults in an alternative school environment differ from the young adults found in a typical high school setting. This finding could explain the more positive performances

displayed by the former group of random-oriented students in a self-paced and flexible learning environment.

Results from the present study indicated only one significant difference in the student choice of CAL by cognitive style--female students preferred the highly interactive references moreso than the males. This was a surprising finding since the females displayed a predominantly abstract random (AR) style that is associated more with personal feelings and attachments rather than materialistic searches. Another, but expected, significant difference was that young adults used computers more than adults. In terms of non-users, young adults indicated an equal reluctance to use CAL while female adult non-users doubled their counterparts. A surprising result was that the abstract sequential (AS) cognitive style reported little use of the reference CAL systems. Gregorc (1982) portrayed this type of learner as one who appropriated objects that contain and that symbolize knowledge.

Limitations of the Research

Although the researcher was involved in the context of the study on a daily basis, his eyewitness accounts might be clouded by preconceived expectations. Generally, the data from the present study was similar whether it was taken from the Delineator sample, the demographic sample, or the interview sample. The quantitative data was further clarified and verified by qualitative observations and reinforced the above findings. Any studies performed by one researcher are

susceptible to exhibiting researcher bias and the above methods were attempted in order to reduce that bias.

The reliability of the Gregorc Style Delineator was deemed moderate when used by itself. However, the literature revealed that when the instrument was used as suggested the results would be considered strongly reliable. Another variety of the test was used in an abbreviated form to explore the accuracy of the results of student cognitive styles. This was completed during the quantitative and the qualitative segments of the study. The researcher made every attempt to discuss with the students the procedure being used, the interpretation of the various cognitive styles, and a review of their own results as suggested by the author of the instrument. Subsequent student interest in the results of the study, in their sharing of other incidents where they became participants in similar research, and in their seeking more information about cognitive styles led the researcher to assume some success in the above process. The literature indicated a need for more open-ended learning environments, for the facilitation of helping the students (especially adult students) to learn how to learn.

The demographic and computer-use questionnaire was used initially during a pilot study to determine its reliability. Results indicated that the subscales used were moderately reliable The questionnaire was later positively correlated with a similar questionnaire at the $p < 0.01$ level.

Although the quantitative samples were relatively small (N = 75, N = 64), the age groups included at least 30 students which was deemed acceptable by Borg and Gall (1989). A dividing of the adult age group to match the adult life phases groups, led to smaller groups of at least 20 students. Any interpretation or comparison of results obtained from these groups, or any of the gender groups within these groups, would require a variety of quantitative and qualitative methods. Although this was attempted by the researcher, inexperience with research methods would dominate.

The type of alternative school portrayed in this study is unique since the school acts as an intermediary for students taking correspondence courses by providing on-site tutors. Learning packages can be developed when deemed necessary by the tutors in consultation with the student. There are no classrooms and students work alone, completing coursework at their pace, and taking exams at their request. Some supervision is maintained by school personnel since continual progress is considered a necessary ingredient in independent learning and in student metacognition.

The time period would be considered as a snapshot since only a three month period was used for the study. Student turnover was not as significant during this period as in the past as indicated by the large majority of the students involved in the study who were successful in their learning and who stated a desire to complete their courses in order to continue at post-secondary institutions.

Hundreds of students in the past had started courses but had not stayed with the school. The situation and the student type could vary from season to season--a different population usually enters the school during the summer months because continuing students have the option of taking the summer off. The results of this study might not be representative of students in the immediate past nor of students who enter the program in the future.

All students who were in attendance during the first week of the study were approached to be participants and the sample represented all but nine of those available. Interviews were conducted on a voluntary basis but students were selected from those already in the sample who were in attendance the first day of the week, a time when the researcher was available for the full eleven hour opening. A more random choice of subjects for the interview could have been used. In this type of study, the author of the instrument suggested a continuance of the students' involvement in their own learning how to learn and over a longer time frame. Further verification of the cognitive types would have been preferred at a later date with some follow-up discussion regarding the students' most dominant cognitive style.

Any generalization of the results of this study to a broader population would have to include the above considerations. Similarities and differences within the Storefront School (Broadmead) could be interpreted accurately and conclusions made for that population. However, the similarities and differences

with regular secondary schools, other alternative schools, and other adult education centres would remain possibilities and offer suggestions for providing insights into learning styles and CAL.

Implications for Alternative Schools

The research and the literature indicate a need for student programs to be more self-paced and flexible. School staff would be responsible for facilitation of student resources in an open-ended learning environment. Selection of appropriate resources, especially CAL, should be on a broad basis to meet the needs of a variety of learning styles and to match the coursework of the students.

Rather than evaluating one type of CAL system with other types, research and the literature provide evidence that evaluation of CAL should involve the learners and their learning styles. A variety of CAL would satisfy requirements of most learning styles and would provide a diversity of challenges, including opportunities to engage in higher-level cognitive skills.

Problems will arise when staff attempt to provide the desired CAL only to discover that the hardware requires updating at considerable costs. Some technology plan should be considered to replace outdated hardware, to provide new technologies as deemed pertinent to the program, and to provide the variety of CAL. Limited financial resources necessitate a careful analysis of wants versus needs. Hopefully this will involve the inclusion of the concerns and requirements of the independent learners.

Recommendations Based on This Research and the Literature

Educators are faced with providing opportunities for learners who are expecting a wider range of experiences that are tailored to individual needs. In situations involving adults, the expectations require a necessary alignment to the real world or to the world of work. While differences exist in the learning styles, specifically the cognitive styles, between young adults and adults the reality is that both age groups coexist in present alternative schools. The present research suggests that educators working within these parameters address three factors that affect these learners and their learning environment: learning style, program delivery, and computer-assisted learning.

The study on the demographics of the present sample of students indicated few differences with several other samples of students who were classified as student leavers or drop-outs. Recognition should be given that these students, as a group, have their special needs, and concerns when they attempt to upgrade or to continues their education. Educators within Adult Basic Education centres (ABE), alternative schools, and other second-chance environments need to:

- plan for the randomness displayed by young adults and the abstract random style displayed by the majority of all learners in their approach to information reception and processing (inservice).

- recognize that both adult and young adult groups are equally distributed among abstract and concrete cognitive styles and plan for both types of learning situations.
- plan for the student desire for self-pacing and flexibility in scheduling for the re-entry of the adult and young-adult students (inservice).
- provide an open-ended learning environment rather than a teacher-delivery setting.
- provide staff and an environment which encourages facilitation of independent learning where the students learn how to learn.
- provide a broader range of CAL rather than only the standard learning systems.
- provide computer training during the students' entry into the program that will encourage the student, especially adult females, to select CAL that are most aligned to their work or learning requirements.
- evaluate all resources with inclusion of the learners, not only with staff, to provide for ranges of diversity in challenges to cognitive skills.
- plan financial resources with the intent to replace or upgrade hardware, to provide opportunities with current technologies, and to provide a variety of CAL. Piloting of hardware, new technologies, and CAL should be a goal for any initiatives in this area.

- provide staff support to initiate new programs through inservice, and to modify and use available resources.

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Suggestions for Further Research

MOST OF THESE HAVE NOTHING TO DO WITH THE ORIGINAL QUESTIONS.

The present study has attempted to respond to several questions which were posed for further research. While working through the areas of second-chance learning environments, students' cognitive learning patterns, and computer-assisted learning other questions became apparent. More studies would have to be done within alternative schools to determine whether certain cognitive styles are specific to this educational context. One study reported similar results to the present study while another indicated that certain cognitive styles were not specific to this type of environment.

Although certain cognitive styles were apparent in two studies, the present study was conducted in an open-ended learning environment while the other involved a teacher-directed setting with several differences from the traditional delivery method. Further studies could determine which type of environment is best suited to the cognitive style (random) which dominates the alternative school setting. Is it only the setting which might affect the best learning opportunity for this type of learner or are their other factors such as staffing or CAL systems?

In the present study, approximately 30% of the students chose not to use CAL to assist them with their programs. The researcher was assured that when the window of opportunity presented itself, some of these non-users would request

assistance in utilizing CAL with their coursework. Further research could specifically address this situation where young adults and adults equally choose not to apply the available technologies to their learning. Possible recommendations could include methods for especially engaging adult females in CAL endeavors.

One interesting finding appeared in the present study--given the choices of various CAL the students chose those that most served their needs, independent of cognitive style. More research would be required to validate this observation. As earlier suggested, whenever possible, students should be fully exposed to computers on their entry into the program in order to determine which CAL would best serve their needs. The current study did not involve students who had been equally exposed to CAL.

Further research could inform educators within alternative school settings regarding the effects of CAL on achievement. Although extensive review on computer-use and achievement was presented in the literature, distinctions were suggested but not proven as to the cause of the increase of achievement. Were the results mainly affected by CAL, or by the self-paced, flexible setting, or possibly by some unforeseen factors? In the present situation, such a short time frame taken for the research did not enable the researcher to deal with this concern in depth. When adults enter an alternative program they may be assessed or they may be provided with courses that enable them to upgrade to a desired level before

continuing with graduation level courses. The latter situation was in use at the present study setting for adults. A lack of availability of adult records regarding previous achievement also prevented data for comparison purposes.

Some surprising results occurred in the present research regarding student use of the various types of CAL systems. Female students, the majority of whom demonstrated the abstract random (AR) cognitive style, acted out of character for that style by choosing highly interactive references to an extent that was significantly more than the males' choice. On the other hand, students favoring the abstract sequential style reported little use of any of the reference CAL systems. This was also contrary to that style. The possibility existed that a specific cognitive style was demonstrated by the students to match the particular learning situation at that time since the students had the ability to mediate the information selection and processing using any of the four cognitive styles. Further research would be required to offer suggestions for this possible discrepancy or to provide conflicting evidence. The researcher may have design problems with this section of the study, but none are apparent since the students' and the researcher's reporting of CAL use was very similar.

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APPENDIX A: Letter of Informed Consent

I am researching students' cognitive learning styles and their preferences for computer-assisted learning. The study will help us to utilize the computers and software to the benefit of all the students. The study will be conducted in three parts: a demographic and computer use questionnaire; a self-marking learning style instrument accompanied by a learning style questionnaire; and an audio-taped interview. Your participation in the study is voluntary and you may withdraw at any time. You may participate in one, some, or all of the sections of the research.

The specific interviews and questionnaires will be kept completely confidential. Audio tapes and questionnaires will be stored in a locked cabinet. Your anonymity will be protected through the use of coded numbers and the audio tapes will be erased after the transcription is complete. Your decision to participate or not participate in this study will not affect your status as a student at the Storefront School (Broadmead).

Your assistance in this research is appreciated. Thank you for your time and assistance.

Yours truly,

Colin Collister
Graduate Student, Faculty of Education
University of Victoria

I consent to participate in this research study on the effects of students' learning styles on their preferences for computer-assisted learning. I understand that my participation is voluntary and that I may withdraw at any time. I consent to having my interview session recorded by audio tape with the understanding that the information I give will be kept completely confidential.

Name (PRINT) _____

If asked I would volunteer for an interview. YES ___ NO ___
Signature (If 19 or older) _____
Signature of parent/guardian
(If under 19) _____
Date: _____

APPENDIX B: Demographics, and Computer-Use and Learning Questionnaire

Demographic Self-Description Name _____

1. What is/was your father's occupation?
   (a) Professional/technical/cultural _____
   (b) Manager/owner _____
   (c) Service _____
   (d) Clerical _____
   (e) Manufacturing _____
   (f) Agricultural/fishing/logging _____

2. What is/was your mother's work status?
   (a) Worked full-time _____
   (b) Worked part-time _____
   (c) Homemaker _____

3. My intended or chosen career is:
   (a) Professional/technical/cultural _____
   (b) Manager/owner _____
   (c) Service _____
   (d) Clerical _____
   (e) Manufacturing _____
   (f) Agricultural/fishing/logging _____
   (g) Homemaker _____

4. Rate the following as major reasons for dissatisfaction with your PAST education:

(a) Poor attitudes of teachers.	SA	A	U	D	SD
(b) Courses were not available.	SA	A	U	D	SD
(c) Courses were not covered in depth.	SA	A	U	D	SD
(d) Subjects were not relevant.	SA	A	U	D	SD
(e) I disliked school.	SA	A	U	D	SD
(f) Too many students in one class.	SA	A	U	D	SD
(g) Teachers did not care about students.	SA	A	U	D	SD
(h) Teachers did not care about me.	SA	A	U	D	SD

5. My overall average in my last years of REGULAR school was approximately:
   (CHECK ONE)
   (a) 86 and above -- A -- _____
   (b) 73 - 85 -- B -- _____
   (c) 60 - 72 -- C -- _____
   (d) 50 - 59 -- D -- _____
   (e) incomplete/failed _____

6. My main reasons for leaving REGULAR school were:
   (RANK THE TOP FIVE)

__(a) Lack of interest/dislike/boredom.
__(b) Problems with teachers.
__(c) Discipline problems.
__(d) Poor selection of courses.
__(e) Poor grades.
__(f) Interference with my job.
__(g) Problems at home.
__(h) Marriage/pregnancy.
__(i) Financial problems.
__(j) Moved.
__(k) Skipped classes and fell behind.
__(l) Other _____.

7. Have you used the following?

	(a) Yes/No	(b) hours/week
American Heritage Talking Dictionary	_____	_____
PLATO	_____	_____
Choices 95	_____	_____
Encarta Encyclopedia	_____	_____
ADAMS Essentials	_____	_____
Monarch Notes	_____	_____
Internet (Netscape, NDDL)	_____	_____
Bedford Accounting	_____	_____
Word 6.0 Word-processing	_____	_____
Clarisworks (Spreadsheet, Database)	_____	_____

Computer Expertise

8. How would you rate your computer ability?
(check one) ____ minimal ___ moderate ___ skilled

For the following questions:

0 (not applicable) 1 (not true of me now) 2 3 (somewhat true) 4 5 (very true of me now)
(CIRCLE ONE)

9. I require help to make adjustments when I first get on the computer.
0 1 2 3 4 5

10. I can save my typed file onto my disc without help.
0 1 2 3 4 5

11. When the computer screen displays icons only, I know how to get the word-processor up and working.
0 1 2 3 4 5

12. I know how to insert/remove CD-ROM discs when I want to use the Encarta Encyclopedia.
    0 1 2 3 4 5
13. I ask for help when the compute screen does not show the word processor.
    0 1 2 3 4 5
14. I can access the "Typing Tutor" program even though the word-processor program is showing on the computer screen.
    0 1 2 3 4 5
15. I ask for help when I need to make style changes such as: corrections in my typed assignment, underling, indenting, or erasing.
    0 1 2 3 4 5
16. I know how to help other students/staff in problem solving errors on the computers.
    0 1 2 3 4 5
17. I use a computer at home regularly, and very little time is spent on games.
    0 1 2 3 4 5
18. I need help to access the PLATO program when the computer screen displays "Windows", or a word-processing program.
    0 1 2 3 4 5
19. I can print my word-processing file on the laserwriter printer.
    0 1 2 3 4 5
20. When I need to locate information in an encyclopedia, I would rather use Encarta on the computer than the printed volumes of the World Book encyclopedia series.
    0 1 2 3 4 5
21. I find that too much of my time is taken up trying to get started on the computer.
    0 1 2 3 4 5

Computers and Learning

22. I learn a lot by using PLATO for math, science or language support.
    0 1 2 3 4 5
23. Having Encarta, Monarch Notes, and other reference materials makes my learning easier and more complete.
    0 1 2 3 4 5
24. Learning is best done through textbooks while computers are only for play.
    0 1 2 3 4 5
25. I would rather be taught in a classroom rather than have programs set up for me on the computer in order to help me learn.
    0 1 2 3 4 5
26. When I ask for assistance with my course, I am aware of the choice of also receiving help via the computer.
    0 1 2 3 4 5
27. I prefer the self-paced learning and individualized learning available through computer use, compared to learning in classrooms.
    0 1 2 3 4 5

28. I have learned to problem solve and expand my awareness of how to learn by working on several different computer programs.

    0 1 2 3 4 5

29. I prefer staff to help me by using only the materials provided for my course, rather than have the staff also assist me in using helpful references from the computers.

    0 1 2 3 4 5

APPENDIX C: User Logs

Have you used a COMPUTER today?

Name	Date	Amount of Time	PLATO	CHOICES	ENCARTA	A.D.A.M.S.	MONARCH	INTERNET	ACCOUNTING	WORDPROCESS	DATAPROCESS	TYPING	MACINTOSH

Gregorc Style Delineator (1982) WORD MATRIX

	1	2	3	4	5	SCORING (a)	(b)	(c)	(d)
(a)	objective	perfectionist	solid	practical	careful with detail				
(b)	evaluative	research	quality	rational	ideas				
(c)	sensitive	colourful	nonjudgmental	lively	aware				
(d)	intuitive	risk-taker	insightful	perceptive	creative				
	6	7	8	9	10				
(a)	thorough	realistic	ordered	persistent	product oriented				
(b)	logical	referential	proof	analytical	judge				
(c)	spontaneous	empathy	attuned	aesthetic	person oriented				
(d)	trouble shooter	innovative	multi-solutions	experimenting	practical dreamer				

APPENDIX E: Information Sheet

Suggested Meanings for Selected Words

objective	-not influenced by emotions or personal prejudices.
evaluative	-to examine and judge carefully.
sensitive	-susceptible to the attitudes, feelings, or circumstances of others.
intuitive	-informed by impression rather than by logic.
perfectionist	-person displeased with anything that does not meet high standards.
research	-scholarly investigations.
colourful	-vividly distinctive.
risk-taker	-person willing to suffer harm or loss.
insightful	-detecting the true nature of a situation.
rational	-having the ability to reason.
thorough	-very careful.
logical	-reasoning in a clear and consistent manner.
spontaneous	-arising from an impulse.
referential	-turning to a specific meaning.
empathy	-identifying with and understanding another's situation or feelings.
innovative	-introducing or thinking about something in a new manner.
attuned	-understanding what is going on; being on the same wavelength.
aesthetic	-artistic.

APPENDIX F: Butler's Style Channels (abbreviated)

(not true of me now) (somewhat true of me now) (very true of me now)

1 2 3 4 5

1. Do you love argumentative debates?
   1 2 3 4 5
2. Do others find your points of view unusual?
   1 2 3 4 5
3. Are you driven by your emotions, or do emotions easily control you?
   1 2 3 4 5
4. Do you naturally prefer to order and organize in a conventionally recognized way?
   1 2 3 4 5
5. Is time and efficiency of primary importance to you?
   1 2 3 4 5
6. Are relationships more important to you than accomplishments?
   1 2 3 4 5
7. Do you gravitate to the unknown, the new experience, the unusual approach, the possibilities?
   1 2 3 4 5
8. Do you prefer to do a library report rather than invent a product?
   1 2 3 4 5
9. Is frequent change appealing to you?
   1 2 3 4 5
10. Do you feel you have met the challenge of the day when you have accomplished something?
    1 2 3 4 5
11. Are you a flexible person, more able to "go with the flow" than stick to a schedule?
    1 2 3 4 5
12. Do you find that you never pass a bookstore without stopping and purchasing?
    1 2 3 4 5
13. Are relationships more important to you than accomplishments?
    1 2 3 4 5
14. Do you consider yourself a risk-taker?
    1 2 3 4 5
15. Do you have difficulty with details and directions?
    1 2 3 4 5
16. Do you seek directions because you assume there is a correct way to do the work?
    1 2 3 4 5
17. Do you consider yourself a thinker? researcher? idea specialist?
    1 2 3 4 5
18. Do others look to you to solve problems that they find too complex, or too annoying?
    1 2 3 4 5
19. Do the visual or performing arts, or music and poetry hold special meaning for you?
    1 2 3 4 5
20. Are you recognized for your efficiency, exactness, accuracy?
    1 2 3 4 5

APPENDIX G: Student Interview Questions

Preferred Styles of Learning

1. What is your preferred style (AS, CS, AR, CR) of learning? Do you like problem-solving? Do you have difficulty with detail and directions? Do you prefer to order and organize? Do you prefer doing library reports to making things?

2. Why do you attend an open-ended learning environment rather than a directed-learning classroom? Do you feel this is a second-chance?

3. What resources and choices in the Storefront School (Broadmead) help you learn more/achieve higher than you would in a classroom setting? What aspects of a classroom would be better for you?

Attitudes Toward CAL

4. Do you feel comfortable in using any or all of the computer stations? If so, which ones and why? If not, why not?

5. Are you able to complete your courses satisfactorily with only the materials provided from the school, exclusive of computer materials?

6. Do you find the computers and software available to you are a waste of your time? The best information is in the textbooks?

7. Have the variety of computer programs available to you enabled you to find new ways, improved ways, to help you learn? Word-processing, PLATO, others?

Sources of Their Beliefs

8. What in your past experiences has affected your learning preference positively or negatively?

9. What in your past experiences has made you feel intimidated by computers? Has enabled you to see the computers as a valuable tool?

Concerns and Support in Use of CAL and in Learning in General

10. Are you satisfied, overall, with the availability of and instruction on the computers at the school? Suggestions? Concerns/hindrances?

Changes in Role as a Student

11. Do you see your role as a student changing? Are you more responsible for your own learning? Do you feel as though you must "jump through the hoops" to get your education?

12. What personal factors presently affect your style of learning? Situation, age, new technologies? Positively/negatively?

APPENDIX H: ABE Questionnaire (taken from Thomas & Buck, 1994)

Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
SA	A	D	SD	DK

1. Using the computer for learning made me nervous when I started. SA A D SD DK
2. Using the computer for learning is easy. SA A D SD DK
3. Using the computer for learning allows me to learn at my own pace. SA A D SD DK
4. Using the computer for learning encourages me to work with others SA A D SD DK
5. Using the computer for learning is slower than other learning methods. SA A D SD DK
6. Using the computer for learning provides greater variety in learning activities than other adult learning programs I have attended. SA A D SD DK
7. Using the computer for learning increases my interest in subjects more than other learning methods. SA A D SD DK
8. Using the computer for learning is an efficient use of my time. SA A D SD DK
9. Using the computer for learning means I get the instructor's help when I need it. SA A D SD DK
10. Using the computer for learning allows me to work with materials relevant to my needs. SA A D SD DK
11. Using the computer for learning has made me want to learn more. SA A D SD DK
12. Using the computer for learning has made me a more confident learner. SA A D SD DK

13. Using the computer for learning means most of my time in class is spent working on the computer. SA A D SD DK

14. Using the computer for learning means I feel can use computers in my everyday life. SA A D SD DK

VITA

Surname: Collister Given Names: Colin Trevor
Place of Birth: Sydney, Australia

Educational Institutions Attended:

University of Alberta	1965-1970
University of Alberta	1974-1975
University of Alberta	1981-1984
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Degrees Awarded:

B.Sc.	University of Alberta	1969
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Computers and Business Data Processing 1982
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Publications:

Alberta Education (1978). Junior High School Science Curriculum Guide.

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