ATHABASCA UNIVERSITY

PARTICIPANTS' PERCEPTIONS OF THE EFFECTIVENESS OF A COMPETENCY-BASED APPRENTICESHIP PROGRAM

BY

ANTONY E. RATCLIFFE

A thesis submitted to the

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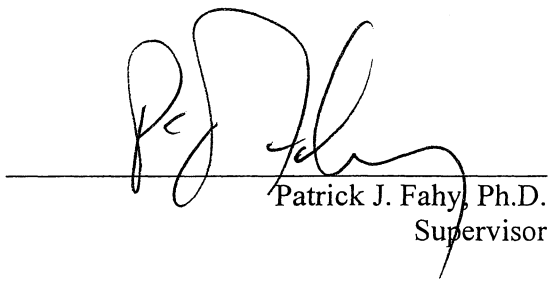
The undersigned certify that they have read and recommend to the Athabasca University Governing Council for acceptance a thesis "PARTICIPANTS' PERCEPTIONS OF THE EFFECTIVENESS OF A COMPETENCY-BASED APPRENTICESHIP PROGRAM" submitted by ANTONY E. RATCLIFFE in partial fulfillment of the requirements for the degree of MASTER OF DISTANCE EDUCATION.



Patrick J. Fahy, Ph.D.
Supervisor

Robert E. Spencer, Ph.D.

Mohamed Ally, Ph.D.

Date: October 25, 2002

DEDICATION

This thesis is dedicated to the students and teachers who come together on the learning journey. For those who want to learn, there are those who want us to be successful. In addition to the faculty and staff, we must always remember the contributions of our student colleagues to our learning. Particularly in distance studies and other forms of independent study, our ability to succeed is made possible by the support of others who are experiencing, or have experienced, the same challenges, barriers, and achievements. Some of these challenges involve the juggling of multiple work, family, and personal responsibilities. To my lovely wife, Lupe, and my son, Andrew, thank you for your understanding when the thesis has limited our family time. I can only hope that I can transfer a lot of what I have learned in the MDE program and thesis to competently guide Andrew as he embarks on a year attending grade 6 through a cyber school.

ABSTRACT

This study examined a Competency-Based Apprenticeship Training (CBAT) Program providing Alberta electrician apprentices with self-paced training within set time parameters, on a classroom or distance delivery basis, encompassing self-study modules, computer-managed learning, skills labs, and tutoring. Theory classes were added for classroom-based apprentices. Program characteristics included elements from Mastery Learning, Keller's Personalized System of Instruction, and Computer-Managed Learning (CML). A personal interview with 40 participating apprentices and 25 instructors identified factors that were deemed to promote or inhibit the success of CBAT and its apprentices. Recommendations support the self-paced program and the importance of the tutorial component. Full-time students may benefit from removing compulsory lectures and providing more freedom to select quiet study, lab skills, computer study, and other areas when needed. Distance and full-time students will benefit from increasing access to instruction and tutorial using computers, providing tools beyond e-mail and telephone for asynchronous or synchronous communications between students and instructors. Opportunities exist to take CBAT beyond the limited availability of human tutorial to computer-based tutorial, reducing the demand on resources for classroom-based CBAT apprentices and increasing access to tutorial services for those studying at a distance.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS USED

CAI	Computer-Assisted Instruction
CAL	Computer-Assisted Learning
CBAT	Competency-Based Apprenticeship Training
CBE	Competency-Based Education
CBET	Competency-Based Education and Training
CBT	Competency-Based Training
CMI	Computer-Managed Instruction
CML	Computer-Managed Learning
CBVE	Competency-Based Vocational Education
DD	Distance Delivery Program
DDs	Apprentices in Distance Delivery CBAT Program
EAP	Electrician Apprentice Program
FT	Full-time Program
FTs	Apprentices in Full-time CBAT Program
ID	Instructional Design
ML	Mastery Learning
PSI	Personalized System of Instruction, referred to as Keller's PSI
TTP	Technical Training Provider
TTPs	Technical Training Providers

CHAPTER I

INTRODUCTION

At various times in our lives, we find ourselves making decisions about our educational and career paths. This may be during the high school years—perhaps earlier—or in later years when changes are contemplated. Some opportunities will present a clear path, while others will offer a degree of choice. Postsecondary education may be pursued that is specific to a career, such as education, medicine, or law. A liberal arts program may be sought for a more general education. Another approach to career preparation and development is that of learning a trade through a formal program of apprenticeship.

The concept of apprenticeship, where an apprentice learns from an employer, has existed since the middle ages. Modern apprenticeship integrates technical training from an educational institution with on-the-job experience. This leads to certification of the apprentice as a journeyman, a qualified tradesperson. In Alberta, the program is formalized by the provincial government, currently with the department known as Alberta Learning. This department registers employment agreements and contracts technical training through educational institutions that are referred to as Technical Training Providers (TTPs) in this study.

Traditional technical training, known as Block Release, removes apprentices from their employment for a set number of weeks each year to attend a TTP. This creates hardships for many apprentices. Alberta apprentices may be living or working in parts of the province far from the nearest TTP for their trade. Apprentices generally receive federal Employment Insurance benefits for the time of the training, at a much lower rate than they are accustomed

to earning and at a time when they may have to pay additional living costs and tuition. They may be reluctant to leave employment for a temporary period of two to three months, particularly at times where their skills are in demand and work is plentiful. Further, employers face the loss of valuable resources at times when trades people are in short supply. As a response to industry and apprentice needs, Alberta Learning has authorized alternative delivery programs that provide more options for access to formal apprenticeship training.

One of these options is Competency-Based Apprenticeship Training (CBAT). In CBAT, the traditional fixed-time program is converted to a self-paced program where the emphasis is on the mastery of the material. Initially offered at selected TTPs with compulsory attendance on a full-time basis (FT), and later extended to distance delivery (DD) at one TTP, CBAT created new opportunities for apprentices to have control over their time and learning.

The current study involved apprentices and instructors who were involved with CBAT at one TTP. Apprentices and instructors answered questions that were designed to help identify factors that promote or inhibit the success of CBAT. The findings provided an insight into FT and DD training and how the strengths and weaknesses of each delivery method could be considered in relation to the overall CBAT program. Also considered are two recent studies. The Northern Alberta Institute of Technology (2000) evaluated the DD program at this TTP. The second study, HarGroup Management Consultants (2000), was presented and summarized in Alberta Learning (2001). They were instructive in the drawing of the following general conclusions about FT and DD methods.

Full-time Studies. FT studies offer an excellent opportunity for electrician apprentices to be trained according to their past experience and ability to progress. Rather than

proceeding at a class pace, many can move ahead and return to employment at an earlier time, while others can receive additional instruction. All can spend extra time in areas where more help is required mastering concepts. Minimal time is spent with familiar material.

A high percentage of apprentices take CBAT through FT studies as the only option available or known to them. However, with a higher completion rate than in traditional Block Release, it is apparent that apprentices adapt to the delivery style.

The nature of the FT program may not provide apprentices with as rich an educational experience as Block Release. CBAT is oriented toward the testing of competencies. There was concern expressed by instructors that this focus is too narrow and does not provide the broader education that accompanies an instructor-led classroom for a greater number of hours. Recommendations are presented that may increase the learning through the addition of more learning resources.

As a self-paced program, insufficient attention is given to providing resources and scheduling that will support the progress of the faster completers and those requiring more time and assistance. More freedom of movement and choice of study locations are required, including quiet study areas. Further, more instruction on demand could be provided with computer delivery.

Distance Delivery. A significantly high non-completion rate for DDs requires further investigation, but indications were that many register with no intention of completing the period of studies. This allows apprentices to meet registration requirements and remain fully employed. It is suspected that others are not prepared for the demands of full-time employment and concurrent studies.

There is limited access to instructors and other apprentices. Telephone contacts are limited by instructor availability that is restricted to regular school hours, usually on a call back basis. Communication is further inhibited by apprentices with limited telephone access during work hours. E-mail communication is not always satisfactory for explanations of teaching points. Neither telephone nor e-mail can assist apprentices who are studying outside of regular school hours and are in need of immediate help. Communication, particularly after hours, can be enhanced through computer-mediated conferencing, synchronously and asynchronously.

Instructional resources can be made available electronically with computer access. Outdated videos require updating. These images can be digitized for viewing. There is an opportunity to provide numerous smaller files addressing specific teaching points. Computer technology, such as providing simulations, can replace a lot of the need for lab class attendance.

This chapter identifies the purpose of the study and the research questions. Alternate delivery programs and the concept of CBAT are addressed in the background to the study, followed by a discussion of the study's significance. Assumptions, limitations, and delimitations are presented, essential terminology is clarified, and the subsequent chapters are outlined.

Statement of the Purpose

The purpose of this study is to identify factors perceived by participants to promote or inhibit the success of Competency-Based Apprenticeship Training in classroom (FT) and distance delivery (DD).

Research Questions

This study addresses the following research questions:

1. What are the factors that promote or inhibit the success of CBAT programs, as perceived by apprentices and instructors?
2. Are any of the factors identified as promoting or inhibiting success in the classroom-based CBAT program different from those in the distance-based program?

Background to the Study

For a set number of weeks in each year, a traditional Alberta apprenticeship program engages apprentices in theory classes, labs, and testing. Various alternative delivery methods have been introduced in Alberta to meet the needs of apprentices and their employers, including CBAT and DD that have been discussed above. The others are Mobile Delivery and Weekly Apprenticeship Training System (WATS). Mobile Delivery takes training from the TTPs to geographic areas where needed. WATS allows apprentices to attend school one day each week over a longer period while continuing in full-time employment. CBAT provides a modularized, self-paced program that requires daily attendance until complete when taken on a FT basis. Apprentices choosing DD access some of the same components but do not generally attend on a regular basis. DDs are also granted a longer time period to complete the training. In one Alberta TTP's Electrician Apprentice Program (EAP), CBAT and DD are delivered by the same instructors, using the same resources and testing tools. Some literature refers to CBAT and DD as two different programs. However, it was found in

this study that both are CBAT—offered with two delivery methods. They are referenced as FT and DD, and explained in Chapter II.

Mastery performance is assessed with multiple attempts of module tests to achieve mastery before moving on to the next module or supervised test, but only a limited form of ML is achieved in CBAT. While apprentices must reach grades of 90% on module exams before moving ahead, the supervised tests, final exams, and government exam have passing grades far below that mastery level. PSI is observed with elements such as study guides, limited lecturing, and self-pacing. CBAT also includes CML, applying technology to provide recordkeeping and to administer a wide range of practice and module tests on demand. CML is augmented by instructors who enhance the limited feedback from the computer and provide personal tutoring within the CML timeframe. While CML is an essential tool for the overall program, instructors try to reduce the impression that it is primarily a computer-delivered program due to a perception that students and others in the industry are averse to the use of computers.

Significance of the Study

The advantages of a self-paced program such as CBAT were documented some time ago in a final report for the CBAT Project (see Chapter II) in relation to current economic and occupational trends (Continuing Education Project People Inc., 1994). These advantages included increased access, the use of technology for distance delivery, and the ability to recognize prior learning in the development of the workforce. In relation to previous work, the present study identified factors, instructional and otherwise, that were perceived by apprentices and instructors to promote and inhibit the success of CBAT in FT and DD

delivery methods. It examined how success-promoting and success-inhibiting instructional factors may differ between the FT and DD groups. These factors revealed strategies that might enhance the FT and the DD alternatives, with DD capable of providing increased accessibility to apprentices who cannot or do not want to attend on a FT basis. The study also revealed strategies for enhancing the experience of apprentices in the full-time CBAT program (FTs) who would like to reduce restrictions to their ability to proceed through the self-paced program. Two delivery methods present a greater opportunity to meet the needs of apprentices and other stakeholders. Drawing from the strengths of each method, the overall CBAT program may be enhanced, as discussed in Chapter V.

The Kirkpatrick Model (Kirkpatrick, 1998) presented an alternative to program evaluation and suggested that there are more factors to consider than the students' learning as demonstrated on tests. Level 1 of Kirkpatrick's model evaluates reaction to the program as an important measure. In this study, apprentice and instructor responses provided an indication of the satisfaction with the overall CBAT program. With open-ended questions generally asked, salient responses addressed what was important to the respondents. This followed through to recommendations presented in Chapter V to enhance the delivery of CBAT programs. It also identified areas for the focus of future CBAT evaluations.

Assumptions of the Study

The following assumptions were made in relation to the conduct of the study:

1. The cohorts of apprentices interviewed are representative of other cohorts in the same periods of training.
2. Voluntary participation furnished unbiased opinions.

3. The methodology used was an appropriate methodology to follow due to time and cooperation constraints.
4. The participants represent those who are committed to completion of their program and exclude those distance students that have chosen, or not been able, to work toward completion of the program.

Limitations and Delimitations

Several limitations were placed upon the study. The researcher was unable to contact the apprentices directly, relying on those who voluntarily responded to correspondence and announcements inviting participation and to the presence of the researcher at the campus. The access to apprentices in the distance delivery CBAT program (DDs) was further limited, as few attended the TTP at one time. DDs who were encountering difficulties in their progress did not respond, so the lack of success and reasons for non-completion were not addressed.

The study competed with the scarce resource of time availability. While some FTs took advantage of all time available to progress quickly, others were behind and would not take time out from their studies. DDs attending the campus had limited time to complete labs during the day, with the survey as a reduction of this time. Telephone interviews were available, but few were motivated to call the researcher as there was no perceived incentive.

Unknown to the researcher prior to the field interviews, consultants, on behalf of Alberta Learning, had recently conducted a survey of apprentices participating in alternative delivery programs, including CBAT and DD, between November 3, 2000, and December 8, 2000, in a study called *Stakeholder Perceptions of Alternate Delivery Methods of*

Apprenticeship Technical Training (HarGroup Management Consultants, 2000). Some apprentices indicated they had already participated, believing the current study to be the same as the previous HarGroup study.

Delimitations were placed by the researcher. The study is limited to one program at one TTP. It makes no attempt to compare CBAT, in FT or DD methods, to traditional programs or to other TTPs. A statistical analysis was not conducted, in favour of the exploration of factors that were important to the respondents. No attempt has been made to assess the competencies that are being tested in relation to the instructional material. Also, the specific CML delivery system, The Learning Manager, was also not assessed nor compared to other products.

Operational Definition of Terms

The following terms and definitions will assist the reader throughout this study: Competency-based Education and Training (CBET).

> While competency-based programs may vary by definition and approach, evaluation is on an individual basis against pre-established criteria (Forster, 1998, What is CBT? Section). Competencies are often related to skills that are required in the workforce (Field, 1991, p. 13; Fletcher, 1991, p. 19). Competency-based approaches use behavioural objectives for teaching and assessment (Monjan & Gassner, 1979, p. 4; Tuxworth, 1989, p. 11), with CBAT as one example. CBET is encompassing of the areas of education and training, including what is known as competency-based education (CBE), competency-based training (CBT), competency-based instruction (CBI), and competency-based learning (CBL).

Competency-Based Apprenticeship Training (CBAT)

CBAT refers to the specific apprenticeship program offered within the Province of Alberta, "an approach to the technical training of apprentices which allows each individual to progress through training at a rate determined by his/her own capabilities and work experience" (Alberta Learning, n.d.).

Computer-Managed Learning (CML)

CML is based on the themes of individualization, behavioural objectives, and educational technology as "a management information system… used to support the management functions performed by the teacher" (Baker, 1978, p. 14). CML systems include testing, diagnosis of learning needs, and prescriptions to direct learning (Baker, 1978; Szabo & Montgomery, 1992). CML is referred to extensively in literature as computer-managed instruction (CMI) (Baker; 1978; Cooley & Glaser, 1968). At the TTP in this study, the CML Lab includes the tutor desk where instructors provide individual feedback and instruction as necessary.

Distance Education

Keegan (1996) presented distance education as encompassing distance teaching and distance learning (p. 38). Students and instructors are separated by time and/or by distance during all or part of the program, and distance programs may involve the use of technologies to facilitate instruction and two-way communication (Keegan, p. 50).

Individualized Instruction

> "Individualized instruction means adjusting or altering instruction as often as necessary and in whatever ways are required to help individuals reach mastery of the competencies they need to acquire." (Harrington, Johnson, Fagan, Freedman, & Reichman, 1976, p. 3)

Organization of the Thesis

The remainder of the study includes the following chapters:

Chapter II - Review of Relevant Literature

Chapter III - Methodology and Procedures

Chapter IV - Analysis and Discussion Of Findings

Chapter V - Conclusions and Recommendations

References

Appendices

CHAPTER II

REVIEW OF RELATED LITERATURE

Competency-Based Apprenticeship Training, or CBAT, is the name given to one method of delivering apprenticeship training in the Province of Alberta. It is based on a concept envisioned by a task force, transforming the traditional apprenticeship training to a competency-based approach (Dohei, Huising, Stewart, Bloor, & Morrison, 1986). An understanding of the delivery is best obtained through consideration of a range of educational concepts and practices. This chapter identifies related literature, addressing competency-based education and training (CBET) and its philosophical and psychological foundations, followed by mastery learning (ML), individualized instruction, Keller's Personalized System of Instruction (PSI), computer-managed learning (CML), also known as computer-managed instruction (CMI), and Competency-Based Apprenticeship Training (CBAT). It concludes by addressing future applications of individualized learning.

Competency-Based Education and Training

Competency-based approaches to education and training have been known in the USA since at least the late 1960s, but "its origins can, however, be traced further back to the 1920s, to ideas of educational reform linked to industrial/business models centred on the specification of outcomes in behavioural objectives form" (Tuxworth, 1989, p. 11). Tuxworth wrote that teacher education became the focus of CBET, also known as Performance-Based Teacher Education (PBTE), in the 1960s, in an effort to ensure that teachers were competent to serve in the profession. The models that were developed initially

focussed on the achievement of the students, but this shifted to the competence of the teachers and resulted in state governments mandating CBET "as a required approach to teacher training and certification" in the 1970s (Burke, 1989, p. 12). CBET encompasses both competency-based education (CBE) and competency-based training (CBT), and other terminology varies according to the author and program discussed. Competency-based vocational education (CBVE) has been tied to the needs of industry (Field, 1991), while others use it to assess the standards of professionals (Smith & Dollase, 1999; Sullivan, 1995).

The National Consortium of CBE Centers developed "Criteria for Describing and Accessing Competency-Based Programmes" that were accepted in whole or in part by institutions (Tuxworth, 1989, pp. 13-14). The model covered competency specifications, instruction, assessment, governance and management, and the total programme (Burke, Hansen, Houston, & Johnson, 1975, as cited in Tuxworth, pp. 13-14). The specifications for instruction were based on competencies relating to the program and being demonstrated by learners. The programs were to include units of work that were manageable, and instruction was to address "learner style, sequence preference, pacing and perceived needs" (p. 13). Ongoing progress reports to the learner were specified, and the instruction was to be reviewed as a result of feedback received.

A conceptual model for CBE followed and was produced from the work of Elam (Elam, 1971, as cited in Tuxworth, 1989). The model was particularly suitability for vocational institutions, and it had the following implied characteristics:

1. Individualisation of learning.
2. Feedback to learners.
3. Emphasis on exit rather than admission requirements.
4. Systematic program.
5. Modularisation.
6. Student and programme accountability. (Tuxworth, p. 15)

Forster (1998, What is CBT? section) stated that CBT does not have a common definition and it "is generally described in terms of its features or characteristics." The focus is on the measurement of student achievement against set criterion, not the performance of other students. According to Foster, Australia's State of Victoria model relies on industry competency standards, modularization, learning outcomes, on-the-job training, training to meet changing needs and standards, criterion-referenced assessment, and showing competence in each learning outcome. Forster identified additional features used in some educational organizations:

- assessment in the workplace;
- non-graded assessment;
- assessment on demand;
- flexible entry and exit; and
- industry involvement in course monitoring. (Forster, What is CBT? section)

According to Brady (1995), CBET programs were later introduced in the UK and "in a relatively short time, have become a dominant influence in vocational education" (p. 11). Tuxworth (1989) wrote, "In the UK there was patchy and desultory interest in CBET until the early 1980s, when the basis of a firmer training policy was laid by a series of White Papers" (p. 17). Some of the prevalent models find government involved in setting standards (Field, 1991). The UK faced imposed adoption by the National Council for Vocational Qualifications (NCVQ) (Brady, 1995; Burke, 1989; Field, 1991). NCVQ standards did not specify the delivery and assessment methods to be used but focussed on the development of "competence standards and performance criteria" (Tuxworth, p. 17).

Fletcher (1991) wrote, "the purpose of competence-based training is the development of a competent workforce" (p. 13). In the UK, a competence is an ability to complete a work task, while in the United States of America it describes an employee characteristic (Fletcher,

pp. 13-14). Fletcher also noted that the UK system prefers the term "competences," while the USA system uses "competencies" (p. 26). "Competency-based standards are developed and agreed by commerce and industry" (Fletcher, p. 19), but Australia, New Zealand and the UK have government standards at the national level (Curtain & Hayton, 1995).

UK competency-based programs focus on the evaluation of what the student can do, or "explicit behavioural descriptions," known as "performance objectives" (Monjan & Gassner, 1979, p. 4). Such performance objectives need not be limited to vocational and technical training, as they were developed in teacher education and are found in broader based educational programs in higher education (Brady, 1995; Monjan & Gassner, 1979; Tuxworth, 1989). According to Monjan and Gassner, a competency is considered to be achieved once a performance objective is attained. These "*units of competence*" are derived from "*outcome-based* standards of competence" [italics in original] (Fletcher, 1991, p. 14).

Competency-based approaches are not without critics. Kerka (n.d.) presented opposing literature relating to competency-based education and training. Supporting arguments credited the opportunity for individualized learning toward the achievement of goals that can be measured. According to Kerka, both sides support concerns that it is "excessively reductionist, narrow, rigid, atomized and theoretically, empirically, and pedagogically unsound" when a behaviourist approach is taken (para. 3). Mezirow (1981) supported a limited application of competency:

> There is nothing wrong with this rather mechanistic approach to education as long as it is confined to task-oriented learning common to the 'technical' domain of learning… It is here such familiar concepts as education for behavior change, behavioural objectives, needs assessment, competency-based education task analysis, skill training, accountability and criteria-referenced education are appropriate and powerful. (pp. 17-18)

Hyland (1993; 1994) dismissed CBE's relevance in higher education, alleging that it failed to meet standards for experiential learning required at that level. He focussed on the NCVQ but criticized the behaviourist underpinnings of similar CBE models. However, a contrary view presents highly interactive computer-based programs as able to provide experiential learning, subject to considerable investment in the development of such programs (Bork, 1999, 2001; Bork & Gunnarsdottir, 2001).

Philosophical and Psychological Roots of Competency-Based Approaches

A common link is observed with the philosophical and psychological foundations of CBET, ML, PSI, and CML as educational concepts and practices that work together and provide characteristics found in CBAT. While behaviourism is often cited from the psychological perspective, experimentalism is also presented from the philosophical side.

Klingstedt (1973, pp. 8-11) presented experimentalism as the philosophical foundation of CBE. It was from the field of psychology that an understanding of different learning styles has developed, leading to an interest in ensuring success through different instructional methods to achieve the stated objectives. Experimental psychologists found that learning takes place one step at a time, increasing in task difficulty, and that "behaviour modification through operant conditioning" occurs with rewards responsive to the desired behaviour (Klingstedt, p. 9). The application to CBE is a logical progression through the lessons and achievement of competence using behavioural objectives to specify the desired learning and changes. John Dewey was a "central figure" as an Experimentalist, believing "it is important to have a clearly defined purpose" for learning (Klingstedt, pp. 10-11).

CBE recognizes prior learning in that pre-testing can reduce or eliminate the need for instruction. Dewey (1938) considered this:

> It is a cardinal precept of the newer school of education that the beginning of instruction shall be made with the experience learners already have; that this experience and the capacities that have been developed during its course provide the starting point for all further learning. (p. 88)

The prominent behavioural psychologists were experimentalists. In Gagné's work on the conditions of learning, an analysis of the cognitive tasks to be learned, followed by the development of behavioural objectives, allowed the instruction to be structured in a hierarchical approach to learning the material (Baker, 1978; Kearsley, 2001). According to Monjan and Gassner (1979), "the hallmark of competency-based education is a commitment to the definition of all educational goals in terms of explicit behavioral descriptions of what a person is able to do once an educational activity has been mastered" (p. 4).

Mastery Learning

The characteristics of ML are not new. While its roots may be found in history, ML lost its popularity. One explanation given by Block (1971) is that technology was not available to provide the level of support needed. Block wrote that two early programs of the 1920s were the Winnetka Plan and that of Professor Henry C. Morrison, with the latter in effect until the 1930s. Reintroduced in the late 1950s and early 1960s, it was known as programmed instruction and became a part of various instructional models.

Programmed instruction is tied to the behaviourist branch of psychology. The work of Skinner (Skinner, 1954, as cited in Block, 1971, p. 4) identified that to learn a behaviour one has to learn a series of "component behaviours." Block explained that after completing a lesson, a student would be tested to determine if mastery of the behaviour had been achieved.

Successful completion would allow the student to move to the next component, while a failure to master the behaviour would result in feedback and correction. These steps helped some students, but the majority did not require the "small learning steps, drill, and frequent reinforcement" that accompanied programmed instruction (Block, p. 5).

A model developed by Carroll (Carroll, 1963, as cited in Block, 1971) suggested that a student could achieve a given level of achievement if afforded enough time and if the time was actually spent in learning. Also factored into the equation, relating to the student, was "the quality of his instruction and his ability to understand" (Block, p. 6). According to Block, this model was the basis for the model of mastery learning later presented by Bloom in 1968.

ML counters the traditional educational program where an actual, or anticipated, normal curve of the grades sees some students passing with high grades, a group failing, and others just getting through. Adapted from his 1968 paper, Bloom (1971) proposed that "most student [sic] (perhaps over 90 per cent) can master what we teach" (p. 48). He further presented that "our instructional task is to define what we mean by mastery of a subject and to discover methods and materials to help the largest proportion of our students reach it" (p. 48). Bloom believed that the differences in student learning need not affect the amount they were allowed to learn, and ways should be found to develop learning and success. Five variables were discussed by Bloom in relation to mastery learning.

The first variable presented by Bloom (1971) was aptitude. He considered "Carroll's (1963) view that aptitude is the amount of time required by the learner to attain mastery of a learning task" (p. 50). Bloom further cited research and findings that most students will achieve a standard, although with different completion times (pp. 50-51). Bloom believed

that 95% of students can achieve mastery with enough time and help (p. 51). He acknowledged that some students will not be capable of mastering a task, and something must be done to ensure tasks may be completed within a reasonable time, so as not to engage slow students in a seemingly endless process. This might be in part achieved through the second variable, the quality of instruction. Expecting that students will need varying levels of support from the learning process, Bloom wrote, "We believe that if every student had a well-trained tutor, then most of them would be able to master a particular subject" (p. 52). He emphasized that the instruction should focus on individuals and not be left to the assumption that the teaching is good for the whole group.

The ability to understand instruction was the third variable. Bloom (1971) indicated that students should know there are a variety of learning approaches available, which can include such tools as small-group study, tutorial help, varied instructional methods, audio-visuals, and academic games (pp. 52-54). Perseverance is the fourth variable, and it considers the effort put forth by students in response to the learning opportunities available. It can be influenced through successful achievement, with the need for perseverance decreased if the teaching is good. He believed that success should not be limited to a small number.

The final variable is the time allowed for learning. Despite the good intentions of students, success cannot be achieved if adequate time is not made available. However, knowing that time is not a finite resource, Bloom (1971) suggested that effective mastery learning provide strategies to reduce the learning time actually needed (pp. 54-55). Excellent course materials, teaching, group study, and tutorials are among the solutions presented within the variables.

Bloom (1971) chunked courses into units of weekly or bi-weekly learning and provided formative tests at the end of each unit to assess mastery before the student moved on and to assist the student with pacing. If mastery was not achieved, a "diagnosis" of the problem was to be accompanied by a "prescription" of another learning approach to overcome any difficulties presented (Bloom, p. 58). He asserted that formative testing results should be restricted to mastery or non-mastery, being a diagnostic tool and a way to motivate students to continue to work toward mastery—rather than conditioning them to accept lower grades as they proceed through the course. The formative testing also helped identify instructional changes that may be required.

Bloom (1971) discussed a theory course that implemented ML. In 1965, 20% of the class achieved the grade of A on the final examination, before mastery was introduced. The following year, 1966, saw 80% of the students receive an A on a "parallel examination" after working through a mastery approach (Bloom, p. 60). "The highly significant difference in performance between these two groups represents about two standard deviations on the 1965 achievement test" (Bloom, p. 60). An increase to 90% at the A grade level occurred in 1967, when the instructor used the formative test results to improve the instruction.

Studies were conducted by two of Bloom's doctoral students in relation to conventional, ML, and tutoring "conditions of instruction" (Bloom, 1984, p. 4). A finding was that "the average student under mastery learning was about one standard deviation above the average of the control class (the average mastery learning student was above 84% of the students in the control class)" (p. 4). Under conditions of tutorial instruction, the achievement increased to an effect size of two standard deviations. With tutorial instruction, "the average tutored student was above 98% of the students in the control class" (p. 4). He called this the

"'two sigma' problem" and posed the question, "Can researchers and teachers devise teaching-learning conditions that will enable the majority of students under *group instruction* [italics in original] to attain levels of achievement that can at present be reached only under good tutoring condition?" (pp. 4-5).

Bloom's graduate students considered combinations of variables that, together with mastery learning, might provide a two standard deviation difference over the control group. No study was able to exceed two standard deviations, but it was equalled and the one standard deviation difference from mastery learning alone was surpassed when a second variable was introduced. These second variables included ensuring students have enhanced knowledge of the prerequisites required for the course by testing and reviewing. Bloom's students addressed improvement of student processing of conventional instruction, improvement of instructional materials and technology, the home environment and peer group, improvement of teaching, and improvement of teaching of higher mental processes. According to Kulik and Kulik (1987), "Bloom's article is now generally recognized as the classic theoretical formulation on the mastery model" (p. 326).

Rather than presenting numerous individual studies in a literature review, meta-analysis provides a good overview of the areas of interest by using the meta-analytic approach of Glass, McGraw, and Smith (1981) based on effect size. Kulik and Kulik (1987) considered 49 studies of classroom taught courses that compared mastery and non-mastery requirements. The courses ranged from elementary to college level, and they used Keller's PSI or Bloom's ML. Kulik and Kulik clarified one difference between Bloom's and Keller's approaches, namely that Bloom did not include the requirement to master periodic unit quizzes. Several findings were reported by Kulik and Kulik from summative evaluation

results. Forty-seven of 49 studies had positive results from ML. Thirty of the studies with positive results found statistical significance between the learning between groups using mastery requirements and the control, non-mastery, groups. An average effect size of .54 was calculated for the 49 studies (an increase of .54 standard deviations in the average final examination score) with the conclusion that students in the mastery groups reached the 71st percentile on examinations, while the control group was at the 50th percentile. The effect size was greater for "low aptitude students" Kulik & Kulik, p. 339). The effect sizes ranged from an increase of 1.58 standard deviations at the high end to a decrease of .42 standard deviations from the control group. It was noted that the use of ML was integral with other approaches to learning, and the effect due to ML could not be isolated. It was also found that under mastery learning 26% more instructional time was required (Kulik & Kulik, p. 338). According to Kulik and Kulik, higher gains are likely attributable to factors in addition to ML (pp. 326-327).

Individualized Instruction

Individualized instruction can mean learning individually or in a group setting, but the focus is on the success of the individual learner. Learners may have alternative choices that allow them to learn in different ways. This individualization can involve variation in different factors, including "student interests, learning styles, learning modality, ability, rate of progress, etc." (Baker, 1978, p. 8). It has been explained as follows:

> Individualized instruction means adjusting or altering instruction as often as necessary and in whatever ways are required to help individuals reach mastery of the competencies they need to acquire. The emphasis is on meeting individual learning needs, which are assumed to be different from person to person. The most common approaches for meeting these needs include varying the pace of instructional progress, or letting learners go through instruction at the rate that is best for them; varying

> instructional resources, using both materials and media; tailoring learning objectives to the particular needs of each individual; and basing evaluation of student learning on preestablished standards of attainment rather than on a comparison with other students' attainment. (Harrington et al., 1976, p. 3)

The role of the teacher will change according to the way in which individualized instruction is implemented. According to Harrington et al. (1976), the typical teacher role changes to that of managing the resources and ensuring student learning needs are being met. "In short, the individualizing vocational instructor must be a tutor and counsellor, a diagnostician of learner needs, and a prescriber of instructional materials" (Harrington et al., p. 5).

According to Baker (1978), the interest in individualized instruction varied from the early 1900s until the 1960s, at least partly due to the difficulty with management of it. Baker indicated that by the 1960s computers were able to support the new instructional approaches that were appearing. The linkage of individualized instruction to competency-based instruction was asserted by Harrington et al. (1976):

> Since competency-based vocational education stresses helping every learner acquire the specific skills and knowledge needed on the job, and since individuals differ in how they learn, instruction must be varied to help individuals master those competencies. Varying instruction to meet individual needs is the essence of individualized instruction. (p. 1)

Keller's Personalized System of Instruction

According to Kulik and Kulik (1986-87), Keller's PSI joined Bloom's Learning for Mastery to establish ML in the field of education. PSI originated in 1963 as a result of the efforts of Fred S. Keller and three other psychologists, Rodolpho Azzi, Carolina Martuscelli Bori, and Gilmour Sherman, with early work conducted in Brazil (Keller & Sherman, 1974).

Keller (1982) wrote about his work, beginning with his early days of struggle in school. While he obtained a doctorate, his early education was in an inadequate system that allowed him to proceed, without understanding much of what he was learning. Keller attended graduate school with B.F. Skinner, and he was impressed by Skinner's experiments with rats that demonstrated the power of reinforced behaviour. This was applied in Keller's teaching of Morse code where the acknowledgement of correct answers was the reward, rather than the food associated with the rats' behaviour during operant conditioning, otherwise known as reinforcement theory.

Keller (1982) explained that he became an expert in programmed instruction and its application through teaching machines, sequentially presenting small units of information, providing immediate feedback, allowing self-pacing, and addressing the individual learner. Programmed instruction and reinforcement theory were included in the educational plan known as PSI. This plan included nine considerations, paraphrased as follows:

1. Small units of instruction and review, with one to two each week.
2. Self-pacing by students.
3. Expectations clearly stated to students. Mastery of material before moving on, with no penalty for repeating a test.
4. Use of student proctors from previous classes to mark tests and review with students, awarding credits to student proctors if possible.
5. Periodic lectures or demonstrations without compulsory attendance or testing based on the material.
6. Instructor nearby to respond to proctor and student clarification needs.
7. Course materials and test questions promptly modified based on feedback.
8. Grades of A allowed for all who successfully complete.
9. Support of the institution's administration, including the time and money needed. (Keller, 1982, pp. 68-69)

Later changes to the plan included the selection of advanced students within the same class to act as proctors, the training of proctors to provide tutoring beyond just marking work, and the opportunity to conduct testing through verbal interviews (Keller, 1982). As noted by

Keller and Sherman (1974), "the use of a programmed text, a teaching machine, closed-circuit television, or a computer is possible under PSI. It may even be desirable at times. But such devices are not to be equated with the system itself" (p. 19). Technology may support the concept of the basic PSI plan.

In Kulik and Kulik's (1987) meta-analysis of 49 studies, previously discussed under the Mastery Learning section, gains were even higher where Keller's PSI strategies were used (p. 336). Under PSI, "learners must continue to work on unit material and to repeat unit quizzes until they demonstrate mastery on a quiz. In Bloom's model, learners do not usually have to demonstrate mastery formally on quizzes" (Kulik & Kulik, p. 328). The PSI includes the "use of study guides, reduction in amount of lecturing, and self-pacing," which may provide "attitudinal and other effects" beyond the results of the mastery testing (Kulik & Kulik, p. 340).

Sherman (1992), one of the founders of PSI, reflected on its past and recent states. He identified the positive findings, including those of Kulik, Kulik, and Cohen (1979), and he identified the generally positive acceptance it had received. Lectures may be the one feature of questionable value, found to "have no discernible effect on student achievement." (Kulik, Jakse, & Kulik, 1978, as cited in Sherman, 1992, p. 60) Sherman also noted some of the difficulties that have faced PSI. A reluctance to change an established educational system and paradigm of teaching was one. Not all PSI courses were clearly such. According to Sherman, changes to the characteristics left questions as to whether a course success or failure was due to PSI. The Georgetown Center for Personalized Instruction produced the *PSI Newsletter* and the *Journal of Personalized Instruction*. Sherman wrote that when the Center closed due to funding concerns, and the journal ceased, the publication of related articles diminished. He

also indicated that there is not a count available as to how many PSI courses exist. Sherman wrote of an experience he faced, and the result:

> Avoiding a frontal attack, the chairman of the Psychology Department at Georgetown declared by fiat that something on the order of 50% of class time must be devoted to lecturing. By reducing the possibility of self-pacing to zero, this effectively eliminated PSI courses. He issued this order on the grounds that in the context of lecturing "it is the clash of intellects in the classroom that informs the student." (p. 63)

PSI is practical for the delivery of distance programs that, by nature, require independent study. With the Internet, there may be new opportunities for PSI (Price, 1999). According to Price, whether intended or not, correspondence courses that are print-based tend to demonstrate the elements of a PSI course, including self-paced within a specified timeframe, written objectives and directions, readings, assignments, and proctoring. Additional materials have been included in some courses, and the World Wide Web is a location of some resources. Referencing Texas Tech University, Price wrote, "The major elements of the PSI model are included in almost all of the university's individual study courses that are available on the Web" (p. 24). He provided a model for Web-course delivery, and noted that non-completion of courses can occur with feelings of isolation from the absence of regular personal contact with instructors and students. For this, he pointed out the use of e-mail and class listservs to maintain communication.

Brothern and Bazzarre (1998) found that making personal contact to obtain commitment can be used effectively to deal with procrastination. In a study conducted in an introductory first-year psychology course at the University of Minnesota, taught with a PSI approach, 65 students failed to complete required quizzes by the end of the fourth of 10 weeks in the course. This course was developmental, in that it prepared students to achieve standards necessary to enter a degree program. The researcher, the class teaching assistant,

contacted 22 of the students in person, identified the concern with their individual lack of progress, and asked them to schedule a time that week to complete a quiz. The quiz was taken as scheduled by 10 (45%) of the 22 in what was known as the intervention group. The control group became 53 students who were not contacted. None of them took a quiz. Brothern and Bazzare found the results to be statistically significant. During the course period, the intervention group wrote more quizzes than the control group, spent more time on tasks, and achieved higher grades. The time spent on task "was strongly related to final grade" (Brothern and Bazzarre, p. 9).

Coldeway and Spencer (1982) considered the use of PSI in distance education. They recognized that distance learning often includes elements of PSI, such as printed materials, ML, and tutorials. However, PSI was thought to add structure with frequent testing of related behavioural objectives and the provision of immediate feedback. In a study conducted at Athabasca University, students used telephone contact to provide answers to quiz questions and receive immediate feedback from tutors. A mastery score of 80% was required to proceed. Coldeway and Spencer reported a higher completion rate of 34% for the group using telephone contact (n=38), while completion rate were 12% for the control group (n=95), 19% for those using self-correction of quizzes in the material (n=36), and 21% of those mailing quizzes for correction (n=38). Positive results were also observed in relation to the quality and quantity of telephone contact with tutors by those students using the telephone for grading and feedback, with more contact, longer calls, and more discussion of course content.

Coldeway and Spencer (1982) discussed the advantages and disadvantages of using PSI in distance learning. Credit is given to the instructional design and the structure that

clearly sets out the program and relationship between the learner, tutor, and course materials. Recordkeeping is kept up-to-date, and PSI may be integrated with other instructional materials and approaches to instructional design and delivery. The learner responsibilities include their own active learning. Coldeway and Spencer also considered disadvantages that may make PSI less appealing for some distance learning situations. They concluded that "the advantages appear to far outweigh the disadvantages when considering PSI as a basic paradigm for distance learning" (p. 70).

Computer-Managed Learning/Instruction

The use of the terms CMI or CML varies with the author's perspective. While either term may be used in relation to education or training (O'Neil, 1981), CMI is predominant in the literature (Baker, 1978; Cooley & Glaser, 1968). A computer program for CMI consists of "a database of course structure and objectives, and test items and instructional activities linked to each objective" (Alessi & Trollip, 1991, p. 387). According to Alessi and Trollip, tests are scored and prescriptions are provided to guide the learner toward instructional material for "the objectives not yet mastered" (p. 387). Baker (1978) introduced three themes that explain the need for CMI systems and provide some of the historical development: individualization, behavioural objectives, and educational technology.

With individualized instruction, "each pupil is employing a different set of instructional materials, proceeding at his own rate, and with a unique pattern of achievement" (Baker, 1978, p. 3). Baker also wrote, "Thus, by the mid 1960's, it was clear that efficient, effective, and timely processing of instructional related data was fundamental to the management of the individualized instruction" (p. 3). This position was also taken by Alessi

and Trollip (1991) relating to individualized instruction and ML. According to Ohlsson (1993), "the original reason to introduce the computer into education was its potential to provide individualized instruction" (p.204).

As the second theme, behavioural objectives allow progress to be measured against expected outcomes (Baker, 1978). The objectives allow the curriculum to be clearly specified and students to know what expectations they must meet. The third theme presented by Baker was educational technology, offering opportunities for new computers to assist in the delivery of instruction. This introduced the opportunities for computer-aided instruction (CAI), or computer-assisted instruction as currently called. Baker saw CAI as the instructional component that was managed through CMI.

Competency-Based Apprenticeship Training

In the Province of Alberta, the application of competency-based principles to apprenticeship training was named Competency-Based Apprenticeship Training (CBAT) in conjunction with an implementation project that began to develop in 1985. CBAT was not the first competency-based program known to apprentices in Alberta. Sheet metal apprentices piloted an early form, from 1970 to 1972, at the Northern Alberta Institute of Technology (Rainsforth, 1991). SLATE was an individualized, self-paced program "on a fixed entry, fixed content, open exit basis," but it did not continue:

> M. Cook, a long time employee with Apprenticeship And Trade Certification, indicated that the demise of the program was probably due to the fact that the program was before its time. Revision of the modules was an onerous task as word processing systems were not available to the instructors. Although considered a success, this method of instruction was abandoned. (Personal interview, M. Cook, January 4, 1991, as cited in Rainsforth, pp. 265-266)

In the early 1980s, CBE was introduced in the Pre-Employment Carpentry Program at Red Deer College on a pilot basis with, according to C.A. Rainsforth, former Dean of Technical Training at Red Deer College, "better than satisfactory" results (personal correspondence, April 26, 1990, as cited in Rainsforth, 1991, p. 267). The modules created for the program were then enhanced and used with first and second year apprentices. Cook (personal interview, January 4, 1991, as cited in Rainsforth) asserted that this new approach was the "application of modularization and the concepts of self-paced learning," in contrast to the CBAT that later developed (p. 268).

During the first year, "some apprentices" completed the program in as little as six weeks, while those taking eight weeks "had poorer reading skills or were poorly motivated" (Rainsforth, 1991, p. 270). Rainsforth noted that those completing early were required to stay and work on extra projects due to the hours of attendance specified in provincial legislation (p. 269). The federal and provincial governments, who were not involved in the planning, had concerns with the project, but "work was continued toward modularization of all four years of the Carpentry trade" (C.A. Rainsforth, personal correspondence, April 26, 1990, as cited in Rainsforth, pp. 268-270). Enrolment subsequently declined in this program, with the retirement of C.A. Rainsforth and a reduced supply in the workforce "during the downturn in Alberta's economy" (Rainsforth, p. 270).

As a partner providing apprentice support payments, the federal government was interested in the potential of CBAT to reduce such payments "by having apprentices complete their training in less than 8 weeks" (Continuing Education Project People Inc., 1993, p. 13). On December 9, 1985, the Director of Program Planning and Development Branch, of Alberta Manpower (as it was known at the time), authorized the development of

"a concept plan for competency-based training in the carpenter, welder and electrical trades" (Dohei, Huising, Stewart, Bloor, & Morrison, 1986, Appendix A). The concept was to be "state of the art," as it combined the existing apprenticeship training with competency-based training (Dohei et al., p. 3). Objectives established for the CBAT program were as follows:

A. Self-paced learning
B. Individual progress
C. Frequent and immediate feedback
D. Standardized competencies
E. Predetermined individualized evaluation
F. Predetermined commencement/individualized completion
G. Uninterruptable [sic] learning [no further discussion of this point found]
H. Competency pre-test
I. Post-course evaluation. (Dohei et al., Appendix D)

The model presented "the concept of fixed learning occurring within a variable time frame" (Dohei et al., p. 3), and it was explained as follows:

> The philosophy of C.B.A.T. is that the learning is constant, or fixed, and the time is the variable. If is felt that the majority of apprentices can learn equally well, if they are given sufficient time and are exposed to an environment conducive to learning. (p. 4)

The CBAT approach was to be of benefit to the apprentices by allowing them to work at their own pace, demonstrate knowledge in an area by taking pretests, and focus on areas requiring further development (Dohei et al., 1986). Further, "the emphasis on learning over teaching directs responsibility on the apprentice, thereby producing a self-reliant and self-confident learner" (Dohei et al., p. 16). Following authorization in 1985, the CBAT program was introduced and evaluated from 1986 to 1993 in electrician, welder, and carpenter apprenticeship programs at several Alberta TTPs (Continuing Education Project People Inc., 1993).

There were to be essential criteria and facilitating criteria for the program to be competency-based (Dohei et al., 1986). The essential criteria presented required prescribed

course content and competency evaluation, while the facilitating criteria were facilitating procedures and administrative procedures. Proposed content consisted of modules and tasks, and competency evaluation was to be testing on each task and module to a standard required in the field of apprentices at their stage of progression (Dohei et al.). Facilitating procedures included the testing process, pretesting of tasks, and the following: "After the orientation, the apprentice, in consultation with the facilitator, will agree upon a pace of learning which he/she feels is reasonable" (Dohei et al., p. 5).

The pilot project commenced with Period 1 (first year) training in October 1988 in three trades and four institutions, involving in excess of 400 apprentices, and formative evaluation occurred during the 1988-1989 year (Continuing Education Project People Inc., 1989). This formative evaluation explained the general features of CBE, including mastery of skills and, in some programs, no requirement to receive instruction if mastery was established.

Period 2 training was introduced in 1989 and subject to formative evaluation, reporting on the first two years of the project (Continuing Education Project People Inc., 1990). This was followed by Period 3 implementation for September 1990 to June 1991 (Continuing Education Project People Inc., 1991). Welders completed after Period 3, while Period 4 CBAT for carpenters and electricians was introduced in the year from September 1991 to June 1992 (Continuing Education Project People Inc., 1992). A summative evaluation was conducted in the fifth year, during which all periods of training were operational (Continuing Education Project People Inc., 1993).

Four questions were addressed in the summative report (Continuing Education Project People Inc., 1993): "Did CBAT achieve its objectives?" (pp. 5-47), "Is CBAT an effective

training approach?" (pp. 48-56), "What are CBAT's advantages and disadvantages?" (pp. 57-86), and "Should CBAT be adopted in Alberta?" (pp. 87-101). Each question addressed various goals. The evaluation covered three trades at four institutions, and it did not include distance studies.

One sub-question of "Is CBAT an effective training approach?" asked, "Is CBAT an effective competency-based training system?" When the timing of examinations was considered, "the average grade was more than 85% for examinations written more than 3 weeks early and less than 65% for examinations written more than 2 weeks late" (Continuing Education, 1993, p. 56). All periods of CBAT were considered for each of the three trades (n=1558), including the electricians (n=828). The following summary was presented:

> Exemplary CBT systems expect achievement levels to be consistent and high. Typically, 80% of learners are expected to achieve 80% of objectives. In CBAT, talented apprentices reached those levels early in the course, but CBAT was unable to maintain those standards with less talented apprentices. In good CBT courses weaker students are able to demonstrate high levels of achievement. CBAT would require major improvements in instructional design to guarantee that both strong and weak apprentices could achieve 80% on final examinations. Nevertheless, that is the promise of good CBT and the purpose of additional learning time. For CBAT to be an excellent CBT system it would demonstrate those results. (Continuing Education, p. 56)

A final report on the CBAT study related CBAT to the identified needs for training in Canada, reported on further evaluation of the project, and addressed the decision-making relating to continuing CBAT (Continuing Education Project People Inc., 1994). Although not specifically addressed in the study, findings supported CBAT's potential role in Canadian apprenticeship training. These included the following three of eight points:

1. Effectiveness of Individualized Learning Approach
   CBAT proved that a system of individualized training based on learning modules could provide results which were comparable to those of traditional training in terms of examination grades, course costs, apprentice satisfaction, training institute support and employer perceptions.

2. Flexible Course Opportunities
CBAT provided a basis for flexible delivery of future apprenticeship training which can be adapted to meet needs of individual employers and apprentices with respect to location, duration and schedules of formal technical training. Institutions gained flexibility to complete courses in shorter timeframes. In addition, opportunities to sponsor short-term programs using CBAT materials opened opportunities for institutions generate revenue through entrepreneurial initiatives in non-apprenticeship training.

4. Standard Curriculum Coverage
CBAT provided a model for standardizing curriculum coverage and testing at different training institutions. Use of detailed learning modules increased consistency for quality of instruction among instructors and provided a vehicle for easier mobility of apprentices to attend different training institutions. (Continuing Education Project People Inc., 1994, pp. 6-8)

The CBAT Management Committee's conclusions responded to CBAT goals that were established, including to "Improve Or Maintain The Quality Of Apprenticeship Training Through The Use Of CBAT" (Alberta Advanced Education and Career Development, 1995, p. i). The finding was presented:

> On the basis of provincial examination marks, quality of CBAT training appears to be slightly less than traditional. However, perceptions are that quality of CBAT training is better because of the comprehensive coverage of all learning objectives. (Continuing Education Project People Inc., 1994, p. 54)

As a result of the study's findings, the Deputy Minister of Alberta Advanced Education and Career Development, as the department was known at the time, provided conditional support for continued CBAT delivery, encouraging possible adoption in other trades (Continuing Education Project People Inc., 1994). She wanted concerns addressed relating to the resource demands caused by twice weekly exam dates in some Edmonton and Calgary Career Development Centres, administered by her departmental staff, and other cost factors (Continuing Education Project People Inc., 1994).

Alberta Apprenticeship and Industry Training Board and Alberta Advanced Education and Career Development (1997) detailed responses to a 1996 discussion paper, *A Vision for*

the Future. Respondents consisted of 505 employers, representing 473 individual employers and 32 employer associations, and 680 employees, composed of 355 journeymen, 176 apprentices, 90 other workers, and 59 employee associations. Seeking the views of Albertans, one question related to the future development of individualized learning and off-campus studies, asking whether alternatives "such as home study or study in a community setting or the workplace, would be desirable" (Alberta Apprenticeship and Industry Training Board & Alberta Advanced Education and Career Development, 1997). The following responses were presented in the paper, not limited to the electrician trade:

> Most of the apprentices and journeymen who provided written comments indicated a preference for maintaining formal classroom instruction. They indicated that they were helped by an instructor's experience, that they benefited from the experiences of other apprentices, and that it was helpful to concentrate on their formal training requirement over an eight-week period. One group of apprentices expressed concern that not all students learn well from computers. They recommended the province continue to offer instructor-based training while providing other options.
>
> Many employers spoke in favour of more flexible methods of formal instruction. They expressed support for day release, weekend instruction, modular approaches, computer-assisted self-study, and other methods that would allow better integration of training with work requirements. Some employers identified that apprenticeship training should reflect demonstrated competency, not time spent in the classroom. A few employers spoke in favour of maintaining block release for the compulsory trades, but noted that alternate methods might be appropriate for some non-compulsory trades. (p. 8)

One TTP, the subject of this study, continued the program beyond the implementation and evaluation period for the electrician trade. This TTP has since modified the program delivery of CBAT to include compulsory instruction classes. The program was also extended to distance delivery in the 1995/1996 year, although the program head indicated that six apprentices started in first period in 1994 (J. Sanders, personal communication, January 16, 2001).

Electrician apprentices complete a four-year program, each year known as a period, after seeking employment and becoming indentured to a journeyman. In each period, apprentices also attend technical training at a TTP approved by Alberta Learning, the government department responsible for apprenticeship. The traditional training for electrician apprentices is 8 weeks in the classroom, with 12 weeks in the fourth period.

CBAT electrician apprentices at this TTP are provided with print modules that contain all study material, while other trades may supplement modules with textbooks. Before, during, or after working through a modularized unit of instruction, apprentices may try the self-check test located with the module. This can serve as a pre-test. In addition, they take module tests on CML to test their understanding of the material. Up to five attempts are given to achieve a grade of 90% before being able to take the next module test (Northern Alberta Institute of Technology [NAIT], 2000, p. 10). These grades do not form part of the school grade, and the tests are not supervised, but failing to achieve the standard requires they meet with their advisor for guidance. After passing a module test, two further review tests are permitted to prepare for supervised tests or final exams.

Upon completion of each series of modules, a supervised test requires a pass mark of 65% and forms part of the school grade (NAIT, 2000). A rewrite is permitted with a maximum grade of 65% recorded, or the grade can be kept, but failing three areas covered by the supervised exams usually means withdrawal or termination. Apprentices are also checked for successful completion of lab skills, and in period 2 there are additional unsupervised exams. Recordkeeping, and an ability to administer a wide range of practice and module tests on demand, is made possible through the use of CML.

FTs attend school six hours daily, for 8 weeks in each of the first three years (each known as a "period") of training, and for 12 weeks in period four. This is generally broken into two-hour sessions, consisting of theory classes, lab, and CML. In periods one and two, the theory classes are only one hour, while CML is three hours. Theory classes allow instructors to lecture or otherwise assist FTs with learning the material. Some apprentices will be ahead of the material being taught, while others will not have reached it. The labs provide hands-on practice and testing of lab skills, called hand skills.

First and second period apprentices attend one campus, with designated instructors, while third and forth period apprentices are at a different campus with other instructors. When CBAT was introduced, extensions were allowed based on a total time of 150% of the scheduled weeks. This was later reduced to a total of 125% of the scheduled weeks, being 10 weeks for periods one to three, and 15 weeks for period four. After that time, an apprentice is required to reregister.

DDs have six months to complete each of periods one to three, and nine months for period four. If apprentices fail to complete, they must reregister. They attend at the TTP campus where lab (hand) skills are evaluated, and they may attend at other times to use the CML lab and associated instructor tutoring. Non-supervised module tests may be taken from any computer with World Wide Web (WWW) access. The supervised CML tests may be taken at the TTP or at other designated or approved locations through the province. Table 1 compares the characteristics of each delivery method.

Alberta Learning (2001) defined distance delivery to include a "scheduled practical component" (p. i). The scheduling is at the request of the apprentices, subject to space

availability. As discussed in chapter IV, this scheduling can be a challenge for apprentices and instructors.

Table 1: Characteristics of CBAT Delivery Methods

	Delivery Method	
Characteristics	FT	DD
Length		
1st to 3rd period	8 weeks	6 months
4th period	12 weeks	9 months
Hours	6 hours daily	Self-paced
Entry/Exit	Fixed entry. Open exit. Extensions to maximum 125% of period hours.	Open entry. Open exit. No extensions.
Residency	Must attend TTP daily.	Attend for testing in lab.
Theory classes	Periods 1 and 2 – 1 hour daily. Periods 3 and 4 – 2 hours daily.	Not available.
Lab	Daily 2-hour classes.	May attend. Must attend for testing. Book attendance.
CML	Periods 1 and 2 – 3 hours daily. Periods 3 and 4 – 2 hours daily. World Wide Web access.	May attend. Can access by World Wide Web. Supervised tests at TI or designated sites.
Exam Grades Modules Supervised Finals (3)	 90% mastery to proceed. 65%. 2nd attempt to maximum 65%. 65%.	Same as FT.

The TTP that is the subject of this study conducted its own evaluation of the DD program, for the school year 2000-2001, to meet government funding requirements following implementation of Internet access to the CML (NAIT, 2000). Included was an assessment of apprentice and instructor satisfaction. The evaluation found apprentice completion rates ranging from 44% to 54%, as shown in Table 2. Those completing the program achieved grades from the TTP at the same or slightly higher average as FTs (see Table 3).

Table 2: Completion Rate for Electrician Distance Delivery, 1999-2000

Period of Study	# Completed	Completion Rate
1	27	53%
2	22	44%
3	19	54%
4	17	50%
Total	85	
Mean	21.25	50.25%

Note. From *Access Fund – program evaluation*, by Northern Alberta Institute of Technology, 2000, p. 3. Copyright 2000 by Northern Alberta Institute of Technology, Institutional Research. Adapted with permission.

Table 3: Average Institute Grades for Electrician Apprentices

Period of Study	Average Grade	
	DD	FT
1	84%	81%
2	85%	84%
3	83%	83%
4	83%	83%
Mean	83.75%	82.75%

Note. From *Access Fund – program evaluation*, by Northern Alberta Institute of Technology, 2000, p. 3. Copyright 2000 by Northern Alberta Institute of Technology, Institutional Research. Adapted with permission.

The TTP survey was responded to by 37 of the 83 DDs (44%) who completed the program and assessed apprentice satisfaction. Overall, NAIT (2000) found "there was a high level of satisfaction for the program and many students agreed that it was beneficial (p. 5). The quality of instruction was rated as satisfactory or very satisfactory by 76% of respondents (p. 10), and personalized help from program staff was rated as excellent or good by 76% (p. 12). The availability of lab equipment was seen as excellent or good by 54%, and 65% rated reference books and texts at that level (p. 12).

Responses to the TTP survey by eight instructors addressed instructor related issues, student learning, and technology related statements. They were asked how strongly they

agreed or disagreed with statements relating to the DD program and apprentice learning. The statements focused on the ability of the program to develop apprentices. Instructors did not place a lot of confidence in the DD method. Concerns included students doing the minimum needed to pass, a high non-completion rate, and apprentices wanting to be spoon-fed rather than learning on their own (NAIT, 2000, pp. 20-21). This lack of confidence is reflected in low percentages agreeing or strongly agreeing with the following statements (p. 19): "Develops apprentices who are motivated to learn" (55%); "Develops apprentices who are effective at finding information on their own to solve problems" (72%); "Develops apprentices who are self-directed" (77%); "Develops apprentices who will likely complete trade training and upgrading" (61%); and "Is an effective training method for electrician apprentices" (66%).

Instructors were also asked about their level of satisfaction with technology in the distance program. Satisfaction levels were satisfied or very satisfied for 56% relating to technical support, 39% for the software, and 61% for program delivery by Internet (NAIT, 2000, p. 19).

On behalf of Alberta Learning, a study was conducted by HarGroup Management Consultants (2000) of apprentices (n=1104) and employers (n=628), by telephone, and TTP staff (n=65, 25% administrators and 75% instructors), by mail, in Mobile Delivery, CBAT, Weekly Apprenticeship Training System (WATS), and Distance Delivery (DD). Included were 755 CBAT (FT) apprentices and 134 DDs. This study was "to examine stakeholder satisfaction with program delivery and opinions about the effectiveness of the alternate delivery methods" (p. i). Included in the findings were the following observations related to CBAT and DD:

1. Despite satisfaction with alternate delivery (at least 87% very satisfied or somewhat satisfied with each), Block Release may provide an increased learning opportunity due to more instructor access, hands-on training, and focus on studies with less distractions (pp. i-ii). However, only 33% of DDs were very satisfied with the overall quality (p. 10). CBAT was at 40% and Block Release was at 48%.
2. Learning through DD was found to offer conveniences while providing learning challenges relating to instructor access, concentration of training, and practical training (p. 11). Block Release was in contrast, benefiting from the factors that challenged DDs and finding a lack of convenience (impact on work, finances, and personal life) with the program (p. 11). CBAT apprentices benefited from the access to instructors and the conveniences of self-paced completion and impact on family life. However, they found a challenge in the area of concentration of training.
3. Accessibility has been enhanced by alternate delivery with flexible self-paced and home-based study (p. ii).
4. "CBAT and Distance Delivery respondents, in all three surveys, were less likely than other respondents to state that the technical training improved apprentices' skills and understanding of the trade" (p. ii).
5. "Apprentice respondents who had taken their technical training through CBAT and Distance Delivery were less likely to be satisfied with the 'availability of instructors' and 'promptness of instructors' responses to questions'" (p. ii).

6. HarGroup Managements Consultants (2000) noted apprentice comments that, "there were often too many students in the CBAT classes or students were at different levels, which made it difficult for instructors to provide adequate assistance to students" (p. 17).
7. "CBAT apprentices, who had also taken Block Release, usually preferred CBAT to Block Release" (p. iii). This represented the preferences of 73% (n=97) preferring CBAT. As previously noted, CBAT apprentices do adapt and have high completion and pass rates. This is also supported by the finding that 85% (n=373) of CBAT apprentices (including those who had not taken training by another method) preferred CBAT. Of all DD apprentices (n=89), 68% preferred DD, as did 66% of those having taken more than one method (n=25).

Alberta Learning (2001) quoted from Apprenticeship and Training documentation: "The traditional block release format of apprenticeship training meets the needs of many employers and apprentices, however, alternate delivery is intended to provide improved/enhanced access to technical training" (p. 3). One of the purposes of the Alberta Learning study was to determine whether improved and enhanced access occurs. They found this to occur, "particularly relevant to those employers located outside centres with institutions that offer technical training through traditional delivery" (p. 25).

Future Applications of Individualized Learning

According to Brogan (1999), computers and software are capable of being used to develop an interactive, individualized, adaptive learning system, but there are limitations presented by educational institutions (pp. 14-15). He indicated that the newest equipment is needed, while institutions want the programs to work on both new and old computer models. Development of such advanced software has not been financially viable (Brogan, p. 17).

Bork's (2001) vision is for "much better learning for all" and "learning to be affordable for the individual and the world" (p. 57). He presented the need for economical computer-based tutorial learning for mastery learning. Human tutorial may be superior if feasible on a large scale, but current technology can provide tutorial learning that is highly interactive, individualized, adaptive to the learners' needs, able to test mastery performance, a tool to cause learning by creating knowledge, and capable of supporting peer interaction (Bork, 1999, 2001; Bork & Gunnarsdottir, 2001). Bork (1999) recommended computer-based tutorial learning for campus and distance learning, but he emphasized the opportunities for distance delivery. While the development costs will be significant, the United Kingdom's Open University has demonstrated that delivery to large numbers can occur at a low unit cost per student (Bork, 1999, 2001; Bork & Gunnarsdottir, 2001).

Summary of Review of Related Literature

This chapter has reviewed the literature that pertains to educational concepts and practices explicitly and implicitly apparent in the CBAT program. It has also considered literature that relates to the specific TTP investigated and to the establishment of the CBAT program. The CBAT related literature provides an insight into what was intended in the

development of CBAT along with an assessment of the program as it currently exists. These can be used in comparison to the findings of the current study.

While the CBAT program does not specifically address educational concepts and practices upon which it is based, literature has been identified to provide an understanding of the philosophical and psychological foundations of CBET and the relevance of ML, individualized instruction, Keller's PSI, and CML/CMI. These concepts are important to the understanding of what CBAT is and how it may be developed.

Competency-based programs are identified as assessing knowledge and abilities against pre-determined criteria instead of assessing based on a comparison with others in the class (criterion-reference instead of norm-referenced). ML recognizes that, given enough time, most students can achieve an established mastery level. Until mastery is demonstrated, individual students continue to work on the particular task and do not move ahead. Instruction becomes more of an individualized basis.

Individualized instruction is difficult in a large class under a tradition lecture-style approach. Keller's PSI introduced the use of personal tutoring with knowledgeable students. Although not essential to PSI, CML provided a computerized method of managing the testing and recordkeeping processes that is vital to handling larger groups. Computers also have the ability to direct the study of students, providing feedback and direction to appropriate resources through the integration of CML and computer-assisted instruction (CAI). Recognizing the opportunities of independent learning and human tutorial support, Bork (1999; 2001; Bork & Gunnarsdottir, 2001) has identified the impracticality of human tutorial to large numbers. Current works have asserted the need for the further development of

computer-based tutorials that are highly interactive and adaptable to meet the individualized needs of students, including the opportunity for peer interaction.

The implementation of CBAT in Alberta is described in the literature. Two evaluations extend the literature. One addressed alternate delivery methods for apprenticeship training, and one examined the distance delivery offered by the TTP that is the subject of the current study. These studies, together with the current one, provide an opportunity to address CBAT in relation to the educational concepts and practices identified.

CHAPTER III

PROCEDURES AND METHODOLOGY

This study examined Competency-Based Apprenticeship Training (CBAT) as a program that applies competency-based approaches to apprenticeship training standards within the Province of Alberta. It studied the delivery of CBAT by two methods, in the classroom with daily attendance (FT) and through distance delivery (DD). The study focused on the salient responses provided through interviews with apprentices and instructors describing their perceptions of factors that promote or inhibit the success of CBAT. As such, it is a descriptive study, "research that is designed primarily to describe rather than to explain a set of conditions, characteristics, or attributes of people in a population, based on measurement of a sample" (Alreck & Settle, 1995, p. 445). It makes generalizations based on inference and the quality of description from the interviews.

Apprentices are students of Alberta Learning, a provincial government department overseeing education and advanced education, leading to their participation as a secondary sponsor. The Technical Training Provider (TTP) participating in this study is contracted as a delivery site for apprenticeship training and was the primary sponsor of the research. While the secondary sponsor supported the study, material changes to the methodology were required when a decision was made to severely limit the personal information released, subsequent to an earlier understanding of what would be available. The proposed methodology and the changes are described in this chapter.

Research Design

This study developed as a result of discussions with the TTP's program head for Electrician Apprentice Programs (EAP), followed by preliminary enquires made of instructional staff, apprentices, and Alberta Learning staff. As a result of this early exploration, the researcher developed a greater awareness of the CBAT program and some of the related issues. It became apparent that there were many aspects that were liked by apprentices and instructors, while there were aspects that both groups would identify for increased attention. The study sought to present and assess factors perceived by those involved to promote and inhibit the success of CBAT and its apprentice participants.

Survey instruments were developed subsequent to the preliminary enquiries. The questions were generally open-ended. These instruments, for apprentices and for instructional staff, were reviewed with the program head to confirm the appropriateness of the questions, including a test of the timing of the apprentice questionnaire.

Participants

Apprentices. The researcher originally intended to analyze test data pertaining to students attending second-period and fourth-period EAP training at the TTP that were scheduled to complete their period studies in June 2000. The purpose of the analysis of test results was to classify students as belonging to a quartile (high, upper middle, middle, low). Students were to be approached to participate, based on the quartile they represented. No individual was to be identified in any report, and the results of all analyses were to be completely confidential.

The release of limited personal information would have allowed apprentices to be selected and contacted by telephone. While this information was originally understood to be available, subsequent concerns with the release were raised as more government staff became involved. Approval delays were encountered, and further delays could have affected the ability to conduct the research due to time constraints and the ability of participants to recall events. As a result, a revised proposal was submitted, received prompt approval by both sponsors, and allowed the study to continue.

The application to enter an Alberta apprenticeship program includes a Freedom of Information and Protection of Privacy Notification, advising applicants of the use of their personal information, from the application and that gained throughout the program, for research and statistical purposes. It was proposed that Alberta Learning provide the researcher with apprentice profiles for the approximately 169 apprentices registered with June 2000 completion dates. These profiles would include apprentice contact information, academic results submitted by the TTP, and apprentice exam results.

It was initially agreed with Alberta Learning that they would send an introductory letter to all identified apprentices, advising them of the study, introducing the researcher, and requesting their participation in an interview with the researcher, if contacted. The letter was to advise apprentices that their participation in the interview would be voluntary and might be withdrawn at any time. Further, apprentices were to be advised that they could indicate their wish to not participate when the call was received, at any time during the interview, or in advance by calling Alberta Learning at the number specified in the letter. The anticipated duration of the interview would be specified in the letter and at the outset of the telephone contact. At the time of the interview, apprentices were to again be reminded of the voluntary

nature of their involvement. The letter and the introduction to the interview would promise privacy and confidentiality, permit questions to be asked, and provide the option to terminate participation in the interview at any time.

The change to the methodology removed the opportunity for the researcher to contact apprentices by telephone. Apprentices were then notified in writing of the survey being conducted and asked to participate by voluntarily contacting the researcher. Apprentices in all four periods were included to increase the participation. FTs received a letter from the researcher (Appendix A) given in classes by instructors. DDs received the same letter by mail, accompanied by a covering letter from the TTP (Appendix B). The TTP prepared and mailed the envelopes to avoid personal information being revealed.

The researcher was available by telephone, with a toll-free number for North America, and in person at the campuses where the FTs studied and DDs attended periodically. Interviews could be in person or by telephone. Participation was invited from 235 FTs and 146 DDs, with 29 FTs and 11 DDs responding. FTs in periods one to three had been in class from January 2, 2001, with eight weeks ending on February 23, 2001. Period four FTs commenced the same date but had 12 weeks until March 23, 2001. DDs commenced at various dates from September 2000 forward, with contract dates of six months and nine months for periods one to three and period four, respectively. DDs entering after September 2000 still had to complete within the number of months that commenced in September. Apprentice interviews were conducted from January 29, 2001, to February 22, 2001.

It was obvious in the early days of data collection that significant numbers of apprentices were not going to call in response to the letter they received (see Assessment of the Methodology in this chapter). Arrangements were then made for the researcher to be at

both campuses of the TTP at various times to increase the visibility and access for interviews. This involved a couple of introductions by instructors in lab classes but quickly moved to introductions and availability around the Computer-Managed Learning (CML) lab times. The researcher was introduced to groups of apprentices by an instructor or by himself, inviting apprentices to make contact at the premises or by telephone. Apprentices did approach the researcher, and in some cases the interviews were initiated after casual discussions with apprentices.

Instructors. All 35 TTP EAP instructors, including 2 assistant program heads (collectively referred to as instructors) were invited to participate, representing the two campuses where first and second period and third and fourth period apprentices are taught. Instructors received an introductory letter from the researcher through their immediate supervisor (an assistant program head or the program head) advising them of the study and inviting their voluntary participation (Appendix C). They were afforded the opportunity to directly contact the researcher, but most expressed their interest in participating to the program head and the requests for contact were relayed to the researcher. All instructors agreeing to participate were to be included in the survey. Telephone and face-to-face interviews were available. These interviews were conducted from November 28, 2000, to February 5, 2001.

Data Collection and Recording

The comments of respondents were documented in handwritten notes, not necessarily as direct quotes. These notes were later transcribed. The transcribed notes were reviewed and annotated in the transcription according to themes that appeared to be emerging. These

themes were not pre-selected. Summaries were developed, and illustrative comments were retained to support the salient findings presented.

Assessment of the Methodology

Apprentices were initially asked to contact the researcher to participate in the study, but it quickly became apparent that the response would be minimal. Prompt detection of this factor allowed the researcher to be available at the two campuses attended by apprentices. This served the study, as announcements were made of the researcher's presence, and apprentices responded. It also became apparent that the number and eagerness to participate could have been increased by offering an incentive. This incentive might be as little as refreshments and a snack to divert attention from studies and to break the ice.

The DDs were a greater challenge due to the limited number in attendance at the TTP. Further, their limited lab time required their focus on studies. Contacting them by researcher-initiated telephone calls would increase the participation rate, recognizing additional challenges of telephone inaccessibility while at work and family commitments at home.

The majority of apprentices participating were cooperative beyond expectations, extending the length of interviews. While this commitment was appreciated, a shorter survey focussing on fewer questions would have demonstrated a need for minimal commitment to other potential participants.

Similar participation concerns could have occurred with instructors, as they were asked to contact the researcher rather than releasing their names and contact information. However, the response was high, with most advising the program head that they could be contacted.

While providing contact information to the researcher would be preferable, researchers must recognize the desire of educational organizations to protect the personal information of students and faculty. Even if a general consent is in place, such as that signed by apprentices upon enrolment, it can be anticipated that an informed consent may be required for the specific purpose.

Summary of the Procedures and Methodology

This chapter presented the proposed methodology and the changes required to satisfy government officials that wished to ensure the privacy of its apprentices. Consents are signed by apprentices for the use of their personal information for research purposes. However, this forms part of the apprenticeship program application. While research may be justified based on this general consent, a greater standard of care was taken to ensure that apprentices were specifically informed and consented. This standard provided access to the FTs, as all were still in attendance. However, it significantly limited access to DDs. Few DDs were motivated to telephone the researcher, and they were not readily accessible at the TTP campuses, so research with this group requires further consideration of the ability to contact them.

CHAPTER IV

ANALYSIS OF FINDINGS

The purpose of this study was to identify factors that promote and inhibit the success of Competency-Based Apprenticeship Training (CBAT) in classroom (FT) and distance studies (DD), as perceived by apprentices and instructors. The study originally intended to focus on instructional factors, but the responses identified a variety of aspects that became important to identify. Interviews were conducted with electrician apprentices taking CBAT as FTs and DDs, as well as with the program's instructors. This chapter reviews study findings and consists of three main sections: characteristics of the population, analysis of the responses to apprentice interviews, and analysis of the responses to instructor interviews.

This study addresses the following research questions:

1. What are the factors that promote or inhibit the success of CBAT programs, as perceived by apprentices and instructors?
2. Are there differences in success-promoting or success-inhibiting factors in the classroom-based CBAT program in comparison to the distance-based program?

Characteristics of the Population

The study involved the participation of both apprentices and instructors from the Electrician Apprentice Program (EAP) at a technical training provider (TTP) in Alberta. The voluntary nature of participation resulted in a self-selected sample. According to Alreck and Settle (1995), as a result of self-selection an overrepresentation of certain characteristics of the population might be expected. They wrote that self-selection bias can be reduced by

minimizing the perception that participation is voluntary. Today's emphasis on protecting the privacy of individuals, in ethics review and legislation, tends to require that the voluntary nature be very clear, as occurred in this study with apprentices and instructors.

Apprentices. Forty apprentices were interviewed, consisting of 29 FTs and 11 DDs. At this number of interviews, the in-person response was low and no further telephone calls were received, so the survey was stopped. The length of the interview was recorded for 34 (85%) of the 40 interviews. Interviews ranged from 15 to 42 minutes. The period of studies and delivery method taken by the participants is shown in Table 4 together with the number of apprentices invited to participate and the number that responded. FT responses were 12%, while 8% of DDs responded.

Table 4: Apprentices Invited and Responded to Study

Period of Study	FT		DD	
	Invited	Responded	Invited	Responded
1	30	5	50	3
2	87	11	45	1
3	46	4	28	5
4	72	9	23	2
Total	235	29	146	11
Mean	59	7	37	3

FT apprentices were assigned in their program to classes of 23 to 30 which were divided in half for skills lab classes. Respondents represented each of the classes in session (see Table 5). Class assignments were not considered in the analysis.

Table 5: Cohorts to which Apprentices were Assigned

Period of Study	AB	CD	EF
1	5	no class	no class
2	3	4	4
3	1	3	no class
4	2	5	2
Total	11	12	6

n=40

Interviews were conducted by telephone or in-person, according to the wishes of the participants. All FT interviews and 7 of 11 DD interviews were in-person (see Table 6).

Table 6: Method of Interview with Apprentices

Contact Type	FT	DS
In-person	29	7
Telephone	0	4
Total	29	11

n=40

Most electrician apprentices are male, and this is reflected in the distribution of the participants in Table 7, as identified during interviews.

Table 7: Sex of Apprentice Participants

Sex	FT	DS
Male	28	9
Female	1	2
Total	29	11

n=40

The age of participants is presented in Table 8. The modal interviewee was 25 to 35 years of age in both FT and DD, as determined by the respondents.

Table 8: Age of Apprentice Participants

Age	FT	DS
17-24	11	2
25-35	14	6
Older than 35	3	2
Not identified	1	1
Total	29	11

n=40

The highest level of education completed was also identified by the respondents (see Table 9). One FT completed grade 11, while 55% of FTs and 56 % of DDs completed high school. Postsecondary education, ranging from incomplete university, college, or technical programs to a completed college or technical diploma, second trade ticket, or university degree was reported by 52% of FTs and 44% of DDs (excludes two DDs for which no educational level was recorded).

Table 9: Highest Level of Apprentice Education

Education	FT	DD
High School	13	5
Incomplete university, college, technical or trade	10	1
College or technical diploma	2	2
Second trade ticket	2	1
University degree	1	
Incomplete high school	1	
Total	29	9

n=38 Note. Information not obtained from 2 DDs.

Postsecondary education was identified as follows:

Construction engineering (2 years)
ASET Engineering Technician
Instrumentation Technologist
Cook
Professional Cooking
Engineering Technologist
Partsman
Millwright
Certified Electronic Technician
Pre-employment Carpentry
Telecommunications
Pre-technology
Commerce
Science
Mechanical Engineering

During their technical training, all 11 DDs lived in their usual home. The usual residence was cited by 24 (83%) of the FTs, while 4 (14%) stayed with a friend or relative, and 1 (3%) rented a room (see Table 10).

Table 10: Apprentice Residence during Training

Apprentice Residence	FT	DD
Usual home	24	11
Stayed with friend or relative	4	
Rented room	1	
Total	29	11

n=40

While some FTs travelled a distance each day to class, most resided or stayed within Edmonton. In contrast, most DDs had to travel to attend the skills labs or to access other resources at the TTP, other than the online access to testing. The one-way travel distances, for those commuting, are shown in Table 11.

Table 11: Apprentice Commuting Distance

Distance Travelled	FT	DS
< 25 km.	5	
26 – 50 km.	2	3
51 – 100 km.	1	
> 100 km.	2	6
Not applicable	19	2
Total	29	11

n=40

FTs were readily able to identify their progress level, as an expected percentage of completion is posted each week. DDs have no comparable measure, so they were asked to estimate where they were by giving consideration to factors such as when they started, the

amount of work completed, and when they expect to complete. The progress results are shown in Table 12.

Table 12: Apprentice Progress through the Program

Method/ Period of Study	Ahead	At Expected Progress	Behind
1 FT	3	1	1
2 FT	7	3	1
3 FT	0	3	1
4 FT	1	6	2
1 DS	2	0	1
2 DS	0	0	1
3 DS	3	1	1
4 DS	1	1	0
Total	17	15	8

n=40

As indicated in Chapter III, notification of the study was made to all current apprentices in the FT and DD programs. A significant number of apprentices did not complete the DD program by the end of their contract periods, as indicated in Table 13, with 54% withdrawing during the program. Of the total DDs, 46% completed the TTP training, although 2% did not pass the exam. FTs had a TTP completion rate of 97%, with 6% not passing the government exam.

Table 13: Completion Rate for CBAT Apprentices

Method/Period of Study	Registered	Withdrew	Completed	Completed and Passed Branch	Failed Branch
1 FT	30	1	29	27	2
2 FT	89	2	87	81	6
3 FT	48	2	46	42	4
4 FT	72	1	71	69	2
1 DD	50	26	24	23	1
2 DD	43	22	21	19	2
3 DD	42	23	19	18	1
4 DD	33	19	14	14	
Total FT	239	6	233	219	14
Total DD	168	90	78	74	4
Total All	407	96	311	293	18

Note. After completing technical training, apprentices take a government (Branch) exam. Data obtained from Alberta Learning pertains to apprentices classes related to this study.

Instructors. Face-to-face or telephone interviews were conducted with 25 of 35 instructors (71%), all of whom are male. Instructors had experience ranging from 3 months to 25 years, with a mean of 9.26 years and standard deviation of 9.59. This experience is shown in Table 14. Instructor period assignments are shown in Table 15. Fifty-six percent of instructors had five or more years of experience and 36% had more than 10 years. As a result, there was representation from those who have seen different approaches to apprenticeship training and the evolution of CBAT.

Table 14: Instructor Experience in Electrician Apprenticeship Programs

Years of Experience	Instructors	
	Number	Percentage
First year	7	28%
Second year	4	16%
3 to 4 years		0%
5 to 10 years	5	20%
More than 10 years	9	36%

n=25

Table 15: Instructor Assignment by Period

Assignment	Instructors	
	Number	Percentage
First and second period	11	44%
Third and fourth period	14	56%

n=25

Analysis of Apprentice Questionnaires

Apprentices were asked a series of questions as part of the search for the factors that promote or inhibit CBAT delivery. The results are discussed in this chapter. While themes were identified and quantified, the comments made by apprentices are important. Selected illustrative comments highlight salient points. In Chapter V, conclusions are drawn from this analysis and that of the instructor interviews.

Question #9: When taking module tests, how many attempts does it usually take to get a mastery grade or an instructor pass to the next module?

Apprentices were asked how many attempts of the module tests it usually took to get a mastery grade of at least 90% or an instructor pass to the next module. An instructor pass may be allowed when a grade was quite close to the mastery grade and the apprentice appeared to understand the material. For example, on a test containing nine questions, one wrong answer results in a grade of 89%.

While some apprentices were anxious to move ahead to the next module, another approach was to take extra attempts as a way of seeing more of the questions in the test item bank. The same questions do not appear on the supervised exams, but multiple attempts allow an apprentice to become more familiar with the type of questions and content in the bank. The number of attempts to reach mastery, or before an instructor pass was given, are shown in Table 16. Two or three attempts were required, or used, by 72% of the FTs and 64% of the DDs. This finding suggests that an endless number of attempts need not be made available, and a cap of three may be ideal, always subject to an instructor's option to allow more on an individual basis.

Table 16: Attempts to Reach Mastery or Receive Instructor Pass

# of Attempts	Delivery Method	
	FT	DD
Only 1	6	4
2 or 3	21	7
4 or 5	2	
Total	29	11

n=40

Question #10: How many review tests did you usually take after successfully passing a module?

After successfully passing a module test, apprentices are allowed to take up to two more tests for review purposes. Some take one or more review tests before the supervised exams, while others await the final program exam. Almost half of the apprentices (48% of FT and 45% of DD) had not taken any review tests. One review was usually taken by 34% of FT and 27% of DD. Two were usually taken by 17% of FT and 27% of DD. This does not indicate how many reviews will be taken to study for the final exams, but 80% of all apprentices had additional reviews still available to them. Table 17 presents the responses.

Table 17: Review Tests Taken After Passing Module

# of Review Tests	Delivery Method	
	FT	DD
None	14	5
1	10	3
2	5	3
Total	29	11

n=40

Question #11: On which attempt did you usually pass the supervised exam?

A pass of the supervised exams on the first attempt was usually experienced by 90% of the FTs and 100% of the DDs. This appears to demonstrate that they were well prepared

when taking supervised exams, and it suggests that apprentices are able to identify when they are ready to take and successfully pass an exam. The results are presented in Table 18.

Table 18: Attempts Needed to Pass Supervised Exams

# of Pass Attempts	Delivery Method	
	FT	DD
1	26	10
2	1	
3	2	
Total	29	10

n=39 Note. Response missing from 1 DD.

Question #12: Have you fallen significantly behind at any time? If yes, what help were you offered by an instructor or an advisor?

FTs are able to monitor their progress in relation to where they are expected to be and how the rest of the class is doing. Reports are posted weekly that show expected and achieved progress based on the number of weeks of technical study available. This helps with self-pacing, and apprentices use it to keep up with others. DDs do not have expected percentage of completion targets for each week, and their studies are extended over longer periods of time. While FTs can quantitatively measure whether they have fallen behind, the qualitative response of DDs varies according to self perceptions of personal progress. Responses, shown in Table 19, identified that 17% of FTs and 46% of DDs had fallen behind.

FTs were approached by instructors or advisors and offered help in three cases. Of these, two apprentices caught up and one (still behind) has not accessed the assistance available. One apprentice, who is now at the expected progress level, indicated that there was too much pressure to write exams before being ready. Another two FTs indicated they were not offered help, although one found help once the instructors were approached. The other

had not recognized when slipping to one and one-half weeks behind, but the FT had caught up to within three days of the schedule.

Three DDs indicated that they were not contacted by an advisor. One other DD received a couple of telephone calls, met with the advisor, and had still not made much progress. Another apprentice received a couple of generic e-mail messages but no encouragement. The latter indicated that experience from a prior period provided personal reassurance that a lot of work could be done in a short period of time.

The responses indicate that help is readily available for apprentices that request it, and it is more likely that FTs will be contacted by an advisor if reports show a lack of progress. Due to the extended class period available to DDs, they are not expected to achieve at a set pace, and the reasons for lack of progress are not readily identifiable. It was learned that DD progress reports are prepared infrequently, so monitoring requires that an advisor look specifically at a student record. FTs reported the help and support being available, as indicated by comments that follow the table. DDs' comments suggest that relationships have not been developed with advisors as a supporting function. Responses are shown in Table 19.

Table 19: Apprentice Progress Difficulty – Falling Behind

Fell Behind	Delivery Method	
	FT	DD
No	23	6
Yes	6	5
Total	29	11

n=40

Question #13: From where did you access the CML?

Apprentices were asked from where they accessed the computer-managed learning (CML) testing components. Of the 11 FTs that reported being ahead in their work, 55% had

access from home, and 45% used only the CML Lab. Students with Internet access from home have additional flexibility in their program, as they have more access at a time convenient to them. Responses are presented in Table 20.

Table 20: Apprentice Access Points to CML

CML Access Point	Delivery Method	
	FT	DD
CML Lab	29	4
Home	26	8
Classrooms	2	
Work		3
Career Development Centre		1
Cell phone/laptop		1

n=40 Note. Some use more than one access point.

Question #14: Did you have any previous educational experiences that prepared you for the independent study that you faced in this program? If yes, please tell me what it was.

Previous experience was reported by 28% of FTs and 27% of DDs. The results are shown in Table 21. Previous educational experience that prepared them included high school studies that were correspondence or self-paced, university studies, a modularized preparatory program, preparation to challenge an earlier period of the program, instrumentation background knowledge, and previous trade experience as a millwright.

Table 21: Educational Preparation for Independent Study

Previous Experience	Delivery Method	
	FT	DD
No	21	8
Yes	8	3
Total	29	11

n=40

Question #15: For each of the following (except those not applicable), what is it that most supports your learning, what was the aspect that least supports your learning or impacts it negatively, and what would you suggest for improvement?

Apprentices were asked the above open-ended questions about eight components of the course. These components covered print modules, CML, theory classes, lab classes, help from other apprentices (not a planned CBAT component), videos, and student advisors. Apprentices were initially asked about computer-assisted instruction (CAI), but the question was removed after the 12th interview due to a lack of apprentice familiarity with it and an indication from instructors that very little existed.

Apprentices identified the strengths of each component, demonstrating that each has a place in the training program. The importance or necessity is in part related to the current state of each and future changes that may occur. Highlights are as follows:

Print modules are essential for self-study. Instructional design, writing, and editing updating can improve the presentation and the student learning experience.

CML offers self-paced opportunities for testing and tutorial support from instructors. Computer and instructor resources can be overloaded at times, and computers fail. Updating questions in the test item bank may improve clarity and reduce some questions.

Theory classes are important to those who want the direct teaching of an instructor, including 79% of FTs. The pacing impacts negatively on those who are falling behind or are ahead of the material being covered. While suggestions for improvement were offered by many, 38% of FTs offered no specific input.

Lab classes provide important hands-on practical training opportunities. Time is often spent waiting for an instructor to check work, and DDs have to book limited available time. Updated equipment is desired.

Although not designed into the program, other apprentices provide help and support, as indicated by 100% of FTs and 55% of DDs. Well meaning apprentices are answering with a lack of knowledge. Distractions created in the study area need to be addressed.

Videos provide an additional way of learning material. Outdated videos limit the interest in them. Availability is restricting to in-school viewing, particularly affecting DDs. Student advisors provide a point of contact and support. Access for DDs can be challenging.

15 a. Print Modules

The print modules provide most of the instructional content for the highly theoretical electrician apprentice studies. Responses (see Table 22) credited various aspects of the instructional design (ID) of the print modules as most supportive to learning, followed by them being self-contained and self-paced. Positive comments about the ID included the use of objectives to direct the study, a consistent approach, content relative to the examinations, and the appropriate use of definitions, descriptions, examples, explanations, diagrams, and self-test. Although arguably an ID factor, the self-contained nature of the modules was important. It presented most, if not all, of the relevant material, condensed, and without the need for additional texts. The connection was made between the print modules and the apprentices' opportunity to move ahead at their own pace, spending additional time on material that was not understood, or passing over information that was known. This program relies significantly on a self-contained package, so apprentices are not required to seek a lot of other text resources. One FT commented on being able to obtain higher grades by completing the studies rather than just taking the quizzes as some do.

Table 22: Factors of Print Modules Most Supportive to Learning

Factor	Delivery Method	
	FT	DD
Instructional design	17	8
Self-contained	8	1
Self-paced	4	
Other	1	
No input	1	2

Note. More than one response may be given by a respondent.

While supportive to learning, various ID factors were identified as least supportive to learning by 72% of FTs and 55% of DDs. Recommendations for improvements focussed on ID and writing/editing. Relating to ID, two FTs were concerned that only one approach or point of view was shown, and two indicated that more than one were shown unnecessarily. Other responses indicated a desire for more instructional material, including colour diagrams to more easily distinguish between components, and other explanatory information.

Instructional design favours alternative methods to appeal to student learning, but responses may signify that apprentices do not see a clear path to bypassing instructional material that is understood. Modules are designed for independent study, so an ability to read is important. This was identified as a challenge for some apprentices, particularly in areas of lengthy reading, ambiguity, and a lack of conciseness. Comments suggest that some modules may benefit from the chunking of information to a shorter length that is more easily mastered.

Grammatical errors, misprints, incorrect diagrams and quiz questions, and poor writing were of note. Greater editorial involvement was recommended to correct errors and improve the ability to understand what is read. This includes ensuring conciseness and clarity, expanding content in places.

Responses are presented in Tables 23 and 24.

Table 23: Factors of Print Modules Least Supportive to Learning

Factor	Delivery Method	
	FT	DD
Instructional design	21	6
Writing/editing	3	2
Self-test questions	2	2
Other	2	1
No input	2	

Note. More than one response may be given by a respondent.

Table 24: Suggestions for Improvement of Print Modules

Suggestion	Delivery Method	
	FT	DD
Instructional design	13	4
Writing/editing	6	2
Other	3	1
Self-test questions		1
No input	9	3

Note. More than one response may be given by a respondent.

15 b. Computer-Managed Learning

Apprentices were advised that all aspects of CML could be could be considered, as CML at the TTP included the computers, the CML lab, and the associated tutorial support. Instructors were considered by 48% of apprentices, including 59% of FTs, to be the factor that most supports learning. Only 18% of DDs credited instructors in this area, apparently because instructors are not accessed on a daily basis as they are by FTs. Other factors were instructional design, self-pacing, and accessibility.

During CML periods, apprentices typically have two or more instructors available for individual tutoring on questions relating to the modules, testing, or other related matters. ID factors are particularly important for DDs who cannot turn to an instructor or other students on a regular basis. Both FTs and DDs credited the use of computer testing as a check on what they learned. Multiple module tests can be taken without penalty, and apprentices are not

allowed to proceed until mastery is demonstrated to a rigid criteria or an instructor pass is provided. Although some apprentices indicated that one wrong question should not cause a need to repeat the test, a DD indicated that it caused them to study. Accessibility meant being able to work on the computer from home. Contrary to other comments about noise and distractions, the environment was considered quiet with a comfortable atmosphere talking with instructors.

Responses are summarized in Tables 25 to 27.

Table 25: Factors of CML Most Supportive of Learning

Factor	Delivery Method	
	FT	DD
Instructors	17	2
Self-paced	5	3
Instructional design	2	3
Accessibility	1	2
Environment	2	
No input	3	2

Note. More than one response may be given by a respondent.

The computers and ID factors were identified more often as least supportive to learning, followed by the environment, instructors, and accessibility.

Computers were a problem when they were slow or not functioning correctly, or when there was a long delay printing tests due to other apprentices being ahead in line. Environment conditions relate to the noise levels in the main study area that make it difficult to study. Due to compulsory attendance in the room for FTs, they are often unable to access quiet areas. While instructors were seen as the most supportive factor in the CML, there were concerns with waiting in line and finding explanations that were not helpful.

ID issues primarily relate to the tests. With small numbers of questions, one wrong answer can mean a repeat is required, even if the grade is 1% below the mastery level of

90%. Little feedback is given with answers, at most consisting of the correct Code section to reference. Relating to accessibility, DDs' three general concerns were revealed. First, there are times during the contract period where DDs may not be able to fully access the CML. One DD was locked out over the Christmas break, when progress could otherwise be made, and another commented on the lack of access to CML supervised exams after regular class hours. Second, blueprints are required at a specified point, and they must be picked up from the TTP. As noted elsewhere, this also applies to videos that DDs may wish to view. Third, also identified as an advisor support issue, it may be difficult to receive prompt answers to questions when not at the TTP. Delays and obstacles occur with telephone and e-mail contacts.

The least supportive factors were also addressed as suggestions for improvement, primarily relating to the environment (41% of FTs, 0 DDs), computers (21% of FTs, 0 DDs), instructors (14% of FTs, 9% of DDs), and accessibility (27% of DDs, 0 FTs).

The need for quiet study is emphasized by FTs. Suggestions include supervision of the noise, reducing the number of students in the room, quiet study areas such as secluded booths, focusing the CML lab on exam writing, and having study areas elsewhere. It should be noted that the supervised exams are conducted in an enclosed quiet area, but other studying and module test taking occurs in large open areas.

Apprentices believed that more computers are needed, along with more instructors to reduce lines that may form. Increased accessibility after regular school hours was recommended. One DD stated that blueprints should be scanned for remote reference and all reference material should be on paper or on the computer. The DD stated that failing to do so "destroys the concept of being remote."

Table 26: Factors of CML Least Supportive of Learning

Factor	Delivery Method	
	FT	DD
Instructional design	6	3
Computers	8	1
Environment	8	
Instructors	7	1
Accessibility		4
Other	1	5
No input	6	1

Note. More than one response may be given by a respondent.

Table 27: Suggestions for Improvement of CML

Factor	Delivery Method	
	FT	DD
Environment	12	
Instructors	4	1
Computer	6	
Accessibility		3
Other	2	2
No input	8	5

Note. More than one response may be given by a respondent

15 c. Theory Classes

Most supportive in the theory classes was the role of the instructor, according to 79% of FTs and 18% of DDs. DD responses were based on previous experience with FT studies. Instructors are able to teach the material in a variety of ways, including drawing on the board, providing detailed explanations, lecturing on important parts, and answering questions. Instructors can be stopped and can focus on the areas of interest to the class.

The benefit of instructor lessons is countered by pacing being the least supportive factor in the classes (55% of FTs and 9% of DDs). Other comments (21% of FTs) related to presentations made by instructors. (DDs do not have access to this class, so responses relate to FT study.)

The pace can be fast, so apprentices who are behind are not ready for the material being covered. Apprentices who are ahead have passed the material and may even find it confusing to listen. While it can be argued that the latter can still benefit from the learning, the self-paced concept suggests that apprentices should continue working at their own pace to complete. The theory classes are of interest primarily to those at the lesson being covered, so others find that they are unable to work ahead without distractions. In some classes, apprentices were expected to pay attention. The presentations were of interest to many, if delivered at appropriate times, but the impact was lessened when weak, dry, off topic, not based on more than the module content, not addressing questions of the apprentices, or addressing a subject that was hard to do so on the blackboard. Respondents indicated that the compulsory theory classes conflict with the self-paced concept of CBAT.

Suggestions for improvement included the presentations (28% of FTs, 0 DDs), reducing or eliminating the classes (21% of FTs, 9% of DDs), and increasing or extending the time (10% of FTs, 0 DDs). It is noteworthy that 38% of FTs offered no suggestions for improvement.

Apprentices suggested that presentations be delivered in an understandable way, teaching at the level of the apprentices and not assuming that everything is understood. More help is desired in certain areas, such as with tutorials or additional work assignments. It is apparent that classes of this nature will not reach all apprentices in the way best suited for each individual. Those wanting more classes suggest more theory time. Apprentices wanting the class reduced or eliminated assert that it should be non-compulsory, including references to more CML time as an alternative.

The responses are contained in Tables 28 to 30.

Table 28: Factors of Theory Classes Most Supportive of Learning

Factor	Delivery Method	
	FT	DD
Instructor	23	2
Other	3	1
No input	3	8

Note. More than one response may be given by a respondent.

Table 29: Factors of Theory Classes Least Supportive of Learning

Factor	Delivery Method	
	FT	DD
Pace	16	1
Presentation	6	
Other	3	
No input	5	10

Note. More than one response may be given by a respondent.

Table 30: Suggestions for Improvement of Theory Classes

Suggestion	Delivery Method	
	FT	DD
Reduce/eliminate	6	1
Presentation	8	
Increase/extend	3	
Other	1	
No input	11	10

Note. More than one response may be given by a respondent.

15 d. Lab Classes

The hands-on practical work was cited as most supportive in the labs by 75% of apprentices (86% of FTs, 45% of DDs), while the next most frequent response identified instructors (14% of FTs, 36% of DDs). The overwhelming response was that they liked the opportunity to work through lab assignments that were often new to them. The presence of instructors aided their understanding of the work.

Waiting for the instructor to check the project or otherwise provide assistance was lease supportive of learning to 48% of FTs and 36% of DDs. Outdated equipment was identified by 17% of FTs (O DDs), while two DDs were concerned with the difficulty booking lab space (18% of DDs, 0 FTs). A variety of other comments were grouped together (34% of FTs, 9% of DDs).

Suggestions for improvement of classes related to the equipment (34% of FTs, 9% DDs), wait times (28% of FTs, 9% of DDs), instruction (14% of FTs, 18% of DDs), accessibility (44% of DDs, 0 FTs), and extending the lab time (10% of FTs, 0 DDs).

Apprentices recommended more and updated equipment, and more instructor resources. Individual conversations take a lot of time, so one FT suggested an overview of labs be given to all instead of individually. DDs would like to see more accessibility to lab times including the option of after-hours access and ensuring a full day can be booked as opposed to the half-day restriction often imposed. The responses suggest that efficiencies may be created by scheduling FT and DD apprentices for times that they are ready to actively work on the labs. There are times that they are, or would like to be, working on lab modules or other theory modules. This must be balanced with the input that more time is needed in labs, but the time needs might be changed with the seats filled by those actively working on lab tasks. DDs have indicated that lab assignments can be completed within a few days if productive time is encountered.

Tables 31 to 33 present the responses.

Table 31: Factors of Lab Classes Most Supportive of Learning

Factor	Delivery Method	
	FT	DD
Hands-on/practical	25	5
Instructors	4	4
Other	2	1
No input	1	2

Note. More than one response may be given by a respondent.

Table 32: Factors of Lab Classes Least Supportive of Learning

Factor	Delivery Method	
	FT	DD
Wait time/limited time	14	4
Equipment	5	
Accessibility		2
Other	10	1
No input	4	4

Note. More than one response may be given by a respondent.

Table 33: Suggestions for Improvement of Lab Classes

Suggestion	Delivery Method	
	FT	DD
Equipment	10	1
Wait time	8	1
Instruction	4	2
Extend time	3	
Accessibility		4
Other	4	
No input	3	3

Note. More than one response may be given by a respondent.

e. Computer-assisted Learning (CAL) Lessons

Very early into the interviews, it was determined that apprentices are generally not introduced to the minimal computer-assisted learning available. CAL generally has limited application in a construction safety certification section in the first period. This part of the question was removed after the 12th interview.

f. Help from Other Apprentices

When asked about the support received from other apprentices, 100% of FTs and 55% of DDs credited their student colleagues for helping with understanding of the materials. Such interaction is not a component of the training, and the resulting noise was noted to hinder others who are trying to study. Apprentices bring a range of academic and industry experiences to the program, possibly promoting their participation and sharing as a community of learners. Rather than relying on limited instructional staff, apprentices are often able to help each other work through problems and understand the concepts. Some find that they learn more when placed in the position of explaining to others.

Well meaning apprentices can also be detrimental to the learning process when they lack knowledge (according to 31% of FTs and 55% of DDs) and when it causes distractions (21% of FTs, 0 DDs). Explanations may be incorrect, and it can be frustrating when a partner always seems to have the answer, despite it being wrong. When apprentices help each other, noise distractions increase, and some are held back answering questions.

There were minimal suggestions for improvement, but apprentices recommended distractions be reduced (10% of FTs, 18% of DDs) and apprentices' help be used

appropriately (7% of FTs, 0 DDs). Distractions may be reduced by the lowering of voices or by establishing quiet and discussion rooms.

See Tables 34 to 36 for responses.

Table 34: Help from Other Apprentices Most Supportive of Learning

Factor	FT	DS
Help understanding	29	6
Other	1	1
No input	1	4

Note. More than one response may be given by a respondent.

Table 35: Help from Other Apprentices Least Supportive of Learning

Factor	Delivery Method	
	FT	DD
Lack of knowledge	9	6
Distraction	6	
Other	2	
No input	12	5

Note. More than one response may be given by a respondent.

Table 36: Suggestions for Improvement of Help from Other Apprentices

Suggestion	Delivery Method	
	FT	DD
Avoid distractions	3	
Use of apprentices	2	
Other	1	2
No input	23	9

Note. More than one response may be given by a respondent.

15 g. Videos

Supportive of learning, videos provided an opportunity for apprentices to use a different learning style (41% of FTs, 0 DDs) that was particularly useful to visual learners, and it increased understanding (24% of FTs, 9% of DDs). The identified benefits of videos included the opportunity to see a three-dimensional representation and hear real sounds, and the opportunity to hear something difficult explained rather than read it. It is noteworthy that the use of videos has been limited by apprentices not being aware of applicable videos, not having time, or not being interested in them (38% of FTs, 45% of DDs).

The presentation (45% of FTs, 27% of DDs), instructional level (17% of DDs, 9% of DDs), and accessibility (7% of FTs, 9% of DDs) were identified as least supportive of learning. Apprentices generally described the videos as old and outdated in content and presentation. Comments on the instructional level included that they were too in-depth, lacked enough explanation, were not applicable, and did not provide anything beyond the modules. DDs are required to attend the campus to view videos, and neither FTs nor DDs are generally allowed to take them home for viewing. It was noted that videos are often not watched, particularly in periods three and four.

Suggestions for improvement of videos focused on updating them (52% of FTs, 9% of DDs) and making them more accessible (10% of FTs, 18% of DDs). No suggestions were provided by 34% of FTs and 64% of DDs. Apprentices would like to see more up-to-date videos and have more opportunities to view them, such as taking them home or accessing them remotely. An FT recommended breaking videos into small, easy to digest, segments, and a DDs called for remote access.

See Tables 37 to 39 for responses.

Table 37: Factors of Videos Most Supportive of Learning

Factor	Delivery Method	
	FT	DD
Learning style	12	
Increased understanding	7	1
Other	5	5
Limited use	11	5

Note. More than one response may be given by a respondent.

Table 38: Factors of Videos Least Supportive of Learning

Factor	Delivery Method	
	FT	DD
Presentation	13	3
Instructional level	5	1
Accessibility	2	1
Other	1	
No input	8	6

Note. More than one response may be given by a respondent.

Table 39: Suggestions for Improvement of Videos

Suggestion	Delivery Method	
	FT	DD
Update	15	1
Accessibility	3	2
Other	1	1
No input	10	7

Note. More than one response may be given by a respondent.

h. Student Advisor

The advisor is an instructor who is assigned to particular apprentices. For FTs, the advisor is the lab instructor, while DDs do not share this common relationship. Advisors are credited for the support they provide (62% of FTs, 82% of DDs). They are most supportive

of learning through their helpful and responsive support, concern for success, and providing a little push when needed.

Accessibility and contact were issues for 7% of FTs and 36% of DDs. Advisors are not always readily available, and DDs experienced difficulties with no set contact time. As earlier noted, DDs are not always able to receive return calls, and instructors are not available in the evenings. One DD expressed disappointment with not hearing from the advisor on a continual basis. A large number (72% of FTs, 36% of DDs) had no concerns.

Suggestions for improvement of the advisor role focused on increased contact (21% of FTs, 27% of DDs). This included advisors having more time to spend with apprentices, both FTs and DDs. One DD suggested that more contact would result in the development of deeper discussions.

See Tables 40 to 42 for responses.

Table 40: Factors of Advisors Most Supportive of Learning

Factor	Delivery Method	
	FT	DD
Support	18	9
Other	3	2
Not used	7	
No input	1	

Note. More than one response may be given by a respondent.

Table 41: Factors of Advisors Least Supportive of Learning

Factor	Delivery Method	
	FT	DD
Accessibility/contact	2	4
Other	5	3
No input	21	4

Note. More than one response may be given by a respondent.

Table 42: Suggestions for Improvement of Advisors

Suggestion	Delivery Method	
	FT	DD
Accessibility/contact	6	3
Other	2	1
No input	21	7

Note. More than one response may be given by a respondent.

Question #16: Is there anything else that you liked, disliked, or want to suggest for improvement?

Apprentices were asked if there was anything else that they liked, disliked, or wanted to suggest for improvement in relation to their FT or DD program. A variety of individual comments were made. Many of these comments reiterated the responses made to other questions. The majority of the comments were from FTs in relation to dislikes and suggestions for improvement. It is here that FTs expressed displeasure with the daily attendance requirements and the need to sign-in and be in CML, theory, and lab classes at specified times. There was interest in removing the compulsory aspects based on being at or ahead of the expected completion rate. Apprentices disclosed an apparent conflict between compulsory attendance and the self-paced concept.

Question #17: How strongly do you agree or disagree with this statement: In my classes I have frequent opportunities to discuss topics with my instructor and a small group of apprentices interested in that topic.

While 73% of the DDs found the statement not applicable, 27% strongly agreed. Of the FTs, 66% responded with strong or slight agreement, while 34% slightly or strongly disagreed. It was previously presented that apprentices benefit from the assistance of other

apprentices. FTs are able to communicate on a daily basis, but this opportunity is not afforded DDs who do generally attend the TTP campus on a regular basis. These apprentices use World Wide Web access to testing, but no communication facility has been established for the cohorts and their instructors. Almost three quarters of the DDs interviewed indicated that they are not provided with the discussion opportunities. Although they were just answering a question, and not raising it as an issue, there was little indication that they had thought of the learning opportunities being missed. The concept of cohort programming is identified in Chapter V.

Responses are shown in Table 43.

Table 43: Opportunities for Small Group Discussions in Class

Degree of Agreement	Delivery Method	
	FT	DD
Strongly agree	12	3
Slightly agree	7	
Slightly disagree	6	
Strongly disagree	4	
Not applicable		8
Total	29	11

n=40

Question #18: Which of the following frequency ranges best describes how often you spent time outside of the class with other apprentices for informal study sessions?

The results in Table 44 suggest that a strong community of learners has not been developed, as no significant use of informal study sessions is noted.

Table 44: Informal Study Sessions Outside of Class

Frequency of Informal Sessions	Delivery Method	
	FT	DD
Never	16	8
1 to 5 times	7	1
6 to 10 times	2	1
11 to 20 times	1	
More than 20 times	3	1
Total	29	11

n=40

Question #19: What aspect of the technical training is most helpful to your learning?

A variety of responses were provided, with labs (38% of FTs, 9% of DDs), followed by theory (21% of FTs, 27% of DDs), then instructors (17% of FTs, 9% of DDs) most often cited. The reference to theory included the modules and classes. The responses are summarized in Table 45.

Table 45: Aspect of Technical Training Most Helpful to Learning

Aspect Most Helpful	Delivery Method	
	FT	DD
Labs	11	1
Instructors	5	1
Theory	6	3
CML	2	
Modules		3
Other	9	8
No input		1

Note. More than one response may be given by a respondent.

Question #20: What aspect of the technical training is least helpful to your learning?

Apprentices were asked what aspect of the technical training was least helpful to their training. Responses, summarized in Table 46, identified CML (24% of FTs, 0 DDs), theory 24% of FTs, 0 DDs), modules (17% of FTs, 0 DDs), and accessibility (27% of DDs, 0 FTs). Comments about the CML included the noise and disruptions, while concerns about the theory addressed irrelevant information. Modules were identified due to problems with wording, questions, and out-of-date information. Three comments from DDs about accessibility added to earlier comments that not all of the program resources are readily available to them at a distance, requiring them to attend to do labs and drawings, and communication for questions and advice is challenging.

The absence of reference by the DDs to the modules, CML, and labs underscores the need for these resources to support their distance studies. It is likely that major concerns would have been reiterated in response to this question.

Table 46: Aspect of Technical Training Least Helpful to Learning

Aspect Least Helpful	Delivery Method	
	FT	DD
CML	7	
Theory	7	
Modules	5	
Accessibility		3
Other	10	4
No input	7	4

Note. More than one response may be given by a respondent.

Question #21: What has been the greatest barrier to your learning, at home or outside, during your technical training? How did you deal with it, or how are you dealing with it?

Apprentices were asked what had been the greatest barrier to their learning, at school or outside, during technical training? They were also asked what they did to address it. Responses included personal concerns (24% of FTs, 18% of DDs), inadequate preparation (24% of FTs, 0 DDs), family commitments (14% of FTs, 27% of DDs), school related (14% of FTs, 27% of DDs), employment related (27% of DDs, 0 FTs), and financial (14% of FTs, 0 DDs). No significant barriers were identified across the results; however, results suggest that apprentices may take FT or DD studies without being adequately prepared in more ways than educationally. See Table 47.

Table 47: Greatest Barrier to Learning

Greatest Barrier	Delivery Method	
	FT	DD
Personal (general)	7	2
Inadequate preparation	7	
School related	4	3
Family commitments	3	3
Financial	3	
Employment related		3
No input	6	2

Note. More than one response may be given by a respondent.

Question #22: For what reasons did you choose studies at [TTP] (full-time or distance)?

Apprentices were asked why they chose to complete their technical training at this TTP. In a significant number of cases (79% of FTs, 0 DDs), apprentices attended the program nearest to them or where they had accommodation available. It was the only option for 17% of FTs and 64% of DDs, while few had a specific desire for CBAT or DD (3% of FTs, 27% of DDs). Some decisions were made based on the DD or CBAT delivery or the

TTP's reputation, and a small number were not aware of alternatives. It is apparent that FTs are not choosing to attend this TTP for the CBAT delivery. FTs are required to adapt to the delivery method offered.

Although DDs chose the distance method, it is not necessarily their preferred way of taking their studies. Finding it to be their only option, some apprentices were unable to get into a FT or other traditional program at the preferred time, and financial concerns make DD the only option when not eligible to receive Employment Insurance payments for attending FT or when more money is required to support a family. See Table 48.

Table 48: Reason for Choosing Technical Training Provider

Reason for Choice of TTP	Delivery Method	
	FT	DD
Near home/accommodation	23	
Desire for distance/CBAT	1	3
Other		1
Only option	5	8
No input	1	
Total	30	11

Note. More than one response may be given by a respondent.

Question #23: My interest is in the factors that promote or lessen the success of the electrician apprenticeship training being offered at [TTP]. Do you have any additional comments you would like to share?

Apprentices were also offered the opportunity to provide additional comments about the factors that promote or lessen the success of the electrician apprenticeship programs offered at this TTP. FT responses include comments pertaining to the program quality, self-pacing, instructors, computers, testing, and other thoughts. DD comments are classified as

program quality, instructors, and other. Most comments have been addressed in previous questions. Apprentices revealed overall satisfaction with the FT and DD delivery. Responses do suggest a review of areas where updating could occur to further enhance the success of the CBAT program through FT and DD delivery, such as bringing the content and equipment up-to-date.

Analysis of Instructors' Questionnaires

Twenty-five of 35 members of the instructional staff at the TTP were asked five open-ended questions to solicit their beliefs about the strengths and inhibiting factors of the CBAT program. These questions asked about the instructional factors that promote the success of FTs and promote the success of DDs. They were also asked about the instructional factors that inhibit the success of FTs and inhibit the success of DDs. A final question asked instructors if they had other comments. In this section, an analysis of the responses is presented.

The most significant two responses in each category are highlighted with some of the illustrative comments provided by respondents. These responses are shown in Table 49 and detailed in this section in relation to the study questions.

Table 49: Effects of Instructional Factors on Apprentices

Effect on Apprentice	Delivery Method	
	FT	DD
Promote Success	Self-paced Tutorial	Accessibility Flexibility
Inhibit Success	Learning styles Self-paced	Lack of support Program structure

Question #3: What are the instructional factors that promote the success of apprentices attending the full-time period technical training?

Instructors were asked about the instructional factors that promote the success of apprentices attending the FT program. The self-paced concept and the tutoring process were most frequently identified by 17 of 25 instructors (68%) and 13 of 25 (44%), respectively, as

factors promoting the success of FT apprentices. These factors are closely related, as the tutoring allows apprentices to seek assistance if and when it is needed. Self-pacing permits apprentices to proceed at a rate they are comfortable with, recognizing prior learning in that they are not held back and need only demonstrate the knowledge through testing. Apprentices may take extra time to study, where needed, and they may leave the program early when complete. A significant impact is upon the ability of apprentices to return to their regular family and work life, including the return to the wages that most have not been receiving during training.

Instructors also recognized the ability of the program to respond to different learning styles (6 of 25, 24%), mandatory lectures (6 of 25, 24%), print modules (6 of 25, 24%), the overall CML (4 of 25, 16%), and the labs (4 of 25, 16%). The results, categorized by instructor experience, are contained in Table 50, and those according to instructor assignment (periods of study) are found in Table 51. Illustrative comments are also provided in support of these and other responses.

CBAT supports FT self-pacing by avoiding boredom that may be exhibited if apprentices are held back. CML provides the computer management for exams, issuing and grading them upon demand, freeing instructor time, and the CML tutor desk provides more than one instructor to provide assistance to support the apprentices. One instructor indicated that he spends 80% of his time with 30% of the apprentices, so his time in CML is free to help those who require it. With more than one instructor assigned to the tutor desk, apprentices can seek explanations from instructors with whom they best relate, or they may seek alternative explanations if not understanding something. Developing relationships

through the daily contact, instructors can use the tutoring time to provide the encouragement or push that may be needed.

Table 50: Factors that Promote the Success of FT Apprentices (by Instructor Experience)

Factor	Instructor Experience			
	1st year	2nd year	5-10 years	10+ years
Self-paced	4	3	3	7
Tutoring	3	2	2	6
Learning style	2	1	1	2
Mandatory lectures	2	1	2	1
Modules		2	1	3
CML	1	1	1	1
Lab	2	1		1
Other	2	2	2	1

Note. More than one response may be given by a respondent.

Table 51: Factors that Promote the Success of FT Apprentices (by Instructor Assignment)

Factor	Instructor Assignment	
	Periods 1 and 2	Periods 3 and 4
Self-paced	7	10
Tutoring	7	6
Learning style	2	4
Mandatory lectures	5	1
Modules	2	4
CML		4
Labs	2	2
Other	4	3

Note. More than one response may be given by a respondent.

During interviews, the researcher took notes and made summaries of salient points made by the participants. While the apprentices provided shorter answers, the questions asked of instructors elicited longer, more in-depth answers. For the most significant factors presented in response to each question, selected comments have been presented to further elaborate on the numerical data.

Instructors made the following comments about the self-paced program promoting the success of FTs:

> Students respond to being able to work on own with set tasks and time frames.
>
> Self-paced is tremendous. Progress at rate they are comfortable with.
>
> Can work from home with CML on Internet. Works well with students who like to work on their own.
>
> Students having difficulty can stay longer and pass, instead of repeating. With one to two weeks extra, they usually pass. Fourth period can get four weeks. It must be approved and they must have applied themselves.
>
> CBAT recognizes prior learning. Can move through material more quickly. Others can spend more time.
>
> Can see the pace, creating competition.
>
> Can choose when to write exams. Students can exit the program earlier.
>
> Allows different progress rates. Highly competent can move with ease. Those lacking tasks and skills have more time to develop and learn skills needed for success as a journeyman. Avoids boredom of traditional training for the highly motivated.
>
> Work at own pace. Can leave program early, and marks are generally higher. Can stay full length and get higher marks. Grades vary for early and late completions.
>
> Out of 30, top five don't need instructor, bottom five need help all day, and others need help at times. Those capable can do it. Some learn from books.

Instructors made the following comments about the tutoring promoting the success of FTs:

> Spends 80% of his time with 30% of the students. Frees up his time to help students that need it.
>
> Access to a variety of instructors, therefore different teaching methods

and being able to reach students, particularly through one on one tutoring in CML.

The individual attention to student. Big thing. The one on one and time allows student to understand topic.

Physical presence. Instructor can push if needed. Can stimulate student into looking at things in a different way. Extra help available, but it takes apprentice initiative.

Ability to pre-test and focus studies.

See different approaches by different instructors. Can seek best approach.

Help available at all times, in class. Can feed off more than one instructor if struggling. Push and help if necessary. Non-success readily identifiable, such as needing math upgrading.

Question #4: What are the instructional factors that promote the success of apprentices taking the period technical training by distance studies?

Instructors considered accessibility (17, 68%) and the flexible program (9, 36%) as factors supporting the success of DDs. With self-paced ranked third at 24% (6 instructors), it relates closely to, and supports, the flexibility experienced. As an important distinction, FTs have self-pacing but lack the flexibility of choice relating to when they come to school and which room they can be in. Within the six month contract dates, or nine months for fourth period, DDs are able to set their own study times around work, family, and other commitments. Print modules guide the studies, and World Wide Web access to CML testing allows them to work away from the campus. Supervised testing is accommodated at institutions throughout Alberta, and DDs have telephone and e-mail contact with a designated advisor. With the exception of theory classes, DDs have access to other elements of the program on campus, including the skills lab, the CML lab, and instructor support.

The modules are necessary for DDs, but they were mentioned fourth by 5 of 25 (20%) instructors. The results are shown by instructor experience (Table 52) and instructor assignment (Table 53).

Classified as other comments, four instructors provided characteristics applicable to most DDs:

- They have a first ticket, often instrumentation. They don't have a lot of questions. They are self-motivated to find answers and have access to resources.
- Those with previous academic success do well, such as took higher math than needed.
- Most successful distance students have other trade or post-secondary education.
- From telephone conversations with students, it is the ambition and drive keeping them going.
- Self-motivation essential. Can work through and be quite successful

Table 52: Factors that Promote the Success of DD Apprentices (by Instructor Experience)

Factor	Instructor Experience			
	1st year	2nd year	5-10 years	10+ years
Accessibility	4	4	4	5
Flexible	1	2	1	5
Self-paced	1	2	2	1
Modules		3	1	1
Other	1	1	3	6

Note. More than one response may be given by a respondent.

Table 53: Factors that Promote the Success of DD Apprentices (by Instructor Assignment)

Factor	Instructor Assignment	
	Periods 1 and 2	Periods 3 and 4
Accessibility	9	8
Flexible	3	6
Self-paced	3	3
Modules	4	1
Other	4	7

Note. More than one response may be given by a respondent.

Instructors made the following comments about accessibility promoting DD success:

> Ability to access course content via the Internet. Access to advisor.
>
> Twenty-four hour access to practise test banks. Access to labs on almost any day they are open.
>
> Availability of an advisor by phone or e-mail. Access to CML and CML instructors.
> .
> Can be working in the field anywhere in the world. For those who have to work out of town or can't afford to leave work, they can work and attend at the same time.
>
> System is open for distance students. Access to facility, teaching, and tutorial. Instant feedback from computer system. Immediate response to progress.
>
> A lot of industry information is on the Internet. Can come in for help when really needed.

Instructors made the following comments about program flexibility promoting the success of DDs:

> Only have to attend for labs (1 week total time is the target).
>
> Home study. Don't have to come to school for most of the program. Most can stay employed. Some couldn't leave otherwise.
>
> Advantage of continuing working in career. No need to relocate. His distance students talk of financial constraints. Flexibility.
>
> Can keep working and study weekends. Limited time away from home and family,

lessening problems such as socioeconomic impact, and providing family stability.

Question 5: What are the instructional factors that inhibit the success of apprentices attending the full-time period technical training?

Responses suggest that FT is not suitable for all apprentices. According to 10 (40%) instructors, it may not adequately address different learning styles, and 10 (40%) stated that apprentices find difficulties with the self-paced program. Personal factors were seen as inhibiting by 5 (20%), and theory classes were also mentioned by 5 (20%). Responses are presented by instructor experience (Table 54) and instructor assignment (Table 55).

From apprentice responses, it was apparent that most take the CBAT program as it is the only delivery format available in the Edmonton area. According to instructors, many are not ready for the amount of reading, self-study, and self-pacing that is required. Shortcuts are attempted to testing without adequate study. Theory lectures may be welcomed as resembling the traditional learning they previously experienced, but this relies on the apprentice keeping at the pace of the instructor and the instructor lecturing. If apprentices fall behind or get ahead, the value is lost. They are either not prepared, or they would rather be working on the newer material. The level of instruction varies, so apprentices who learn best from lectures may find instructors doing a minimal amount. Various personal problems impact, including a focus on finances as they cannot afford to be in class.

Table 54: Factors that Inhibit the Success of FT Apprentices (by Instructor Experience)

Factor	Instructor Experience			
	1st year	2nd year	5-10 years	10+ years
Learning style	1	2	3	4
Self-paced	2	2	1	5
Personal	1	1	1	2
Theory class		2	1	2
Other	3	1	1	1

Note. More than one response may be given by a respondent.

Table 55: Factors that Inhibit the Success of FT Apprentices (by Instructor Assignment)

Factor	Instructor Assignment	
	Periods 1 and 2	Periods 3 and 4
Learning style	3	7
Self-paced	3	7
Personal	1	4
Theory class	1	3
Other	3	3

Note. More than one response may be given by a respondent.

Instructors made the following comments about learning style inhibiting the success of FTs:

> Individual's learning style. Some want to work on own. Full-time have no option, as they have to go to classes.
>
> Students are in the habit of memorizing questions. Students take up to four quiz attempts to get all of the questions, although four is the exception. They take the module test and hope to pass. They are surprised on supervised tests with new questions.
>
> If student doesn't learn well from reading, and theory instructor doesn't lecture, it can be detrimental.
>
> Poor, slow students have difficulty getting through. It is not structured enough for about 20%. It takes more discipline. The education is not as rounded as in traditional teaching. Learn the modules. Often memorized. This can show on the government exam.
> Fairly good reading comprehension is required for modules. Some students have poor reading abilities.

A small percentage of students would prefer traditional. More think they don't like it. Often non-success is for many other reasons. There are varying degrees of self-directedness. Some need more help. More responsibility transfers to the student. Some struggle, but just for a short time.

If presentations aren't diversified it can inhibit. Diversity in explanations can lose consistency and create confusion with different instructors. Students can change their approach and have to start over.

Instructors made the following comments about the self-pacing inhibiting the success of FTs:

Slow progress at the beginning catches up with them, and they can't do a good job.

Knowledge of a possible extension can reduce motivation.

Students are not used to self-discipline and don't always adapt. Students can tend to be results oriented. They do minimum work to get through. They learn from quizzes to pass supervised exams.

Despite the structure, some struggle with the CBAT concept. They have to decide what to do in class.

Some need more time. Anyone can be successful with enough time. If too much time is needed, that is not the type of apprentice that is wanted.

Not enough lab time. Students aren't prepared enough.

Time in labs. He has to present the same material 15 times reducing time available to 3-4 minutes per student.

Question #6: What are the instructional factors that inhibit the success of apprentices taking the period technical training by distance studies?

A lack of support was cited by 16 of 25 (64%) instructors, while the structure of the program was identified by 12 (48%). Apprentice motivation and readiness attributed to the lack of success, according to 7 (28%), suggesting that the program is not attracting those best suited for DD studies. This is compounded by an indication that apprentices may register for DD to continue working and avoid going to school. Responses are shown by instructor experience (Table 56) and instructor assignment (Table 57).

The lack of support provided to DDs is attributed to a variety of factors. Access to instructors is limited unless they attend the campus. E-mail and telephone contacts are not immediate, with instructors responding hours, or even a day or two, later, and DDs may not be available for a return call due to their work. Some DDs do not communicate best in these ways, and they miss the face-to-face discussion.

DDs do not have access to lectures, yet some would benefit from them for a greater understanding. They can use the skills labs with FTs, but limited times must be booked in advance. DDs get a lot of work accomplished in few lab visits, if instructors can accommodate, but at other times they must wait their turns along with the FTs. Without regular partners, DDs often find themselves working alone or imposing on others who may be at different points. Much more self-discipline is required for a DD to be successful, so the lack of structure on a daily basis can be detrimental. A lack of motivation will impact on the success of DDs, particularly if registering to avoid attending school and remaining in full-time employment. Grow's (1991) Staged Self-Directed Learning Model suggests significantly more instructor direction is needed for a dependent student who is not motivated to learn or lacks necessary skills.

Table 56: Factors that Inhibit the Success of DD Apprentices (by Instructor Experience)

Factor	Instructor Experience			
	1st year	2nd year	5-10 years	10+ years
Support	6	2	2	6
Program Structure	2	3	2	5
Motivation/readiness		2	2	3
Other			3	2

Note. More than one response may be given by a respondent.

Table 57: Factors that Inhibit the Success of DD Apprentices (by Instructor Assignment)

Factor	Instructor Assignment	
	Periods 1 and 2	Periods 3 and 4
Support	6	10
Program Structure	5	7
Motivation/readiness	4	3
Other	2	3

Note. More than one response may be given by a respondent.

Instructors made the following comments about the program support inhibiting the success of DDs:

> Need more attention for labs. Full-time have 10 hours per week in lab.
>
> Have to juggle instructor time for needs of distance students attending for short-time. They could be doing labs done by others four weeks ago.
>
> When distance students come in, it impacts on instructor time and upsets the classroom. No instructor to ask questions in daily study.
>
> Very limited accessibility to an instructor and other students. Students miss one on one. When students are not active, this leads to communication issues.
>
> May not have tutorial help when doing tests, such as in the early morning.
>
> No personal contact with instructor, other than phone. Instructors lose ability to coach, encourage, and show someone cares—such as with personal and medical issues.
>
> There is no feedback from student to know if material is being processed. It needs tell-show-do with immediate feedback.

Distance students are on their own. Lack of human contact affects motivation. They may have the ability but let it slip. No one is making them accountable. Lack of interaction with other students. In full-time, students understand and help teach others. Lack of teamwork, pairs, and camaraderie.

Don't have access to the lectures. Experience shows that some need extra guidance.

Lack of a warm body to explain and demonstrate. This affects the visual learner. Most seem to be visual learners.

E-mail. Poor writing skills or intimidated by asking obvious or basic questions, so don't ask. Intimidated by physical copy being made.

Inability to sit down with instructor. Can e-mail and phone but it is hard to draw a picture.

Instructors made the following comments about the program structure inhibiting the success of DDs:

Some students come in too late to do lab experiments. It is rare that students come throughout the year.

Some students are not capable of working on their own. May demand too much of instructor time in CML. Feeling of babysitting.

Without good study skills there are distractions such as TV and being called to work. It harms students with poor study skills.

Flexibility can be a detriment. Students need to be self-disciplined and motivated. The length of time can be a disadvantage. Students leave it for a long length of time.

The number one barrier is the size of the courses. 240 hours over 8 weeks, equivalent, is too much for a distance student. It shouldn't exceed 50 hours.

Difficult for some to learn in chunks. Put down for days, weeks, or months and have to start over.

Enticement of working more hours and fun things. Needs self-discipline to get it done. The instructor has no control over these.
Lack of time management. Give up too easy, missing encouragement.

Question #7: Are there any other comments about CBAT or other aspects of the training environment that you would like to make?

Responses address what the staff could be doing to improve the program (9 of 25, 36%), factors promoting the overall success of CBAT (7 of 25, 28%), factors inhibiting the overall success (6 of 25, 24%), and opportunities to address learning styles (4 of 25, 16%). See Table 58 (by instructor experience) and Table 59 (by instructor assignment).

Positive aspects of CBAT included individual comments about lectures and other teaching in theory classes, the opportunity to go faster, the opportunity to adapt to special situations such as death illness or other absences, and the operation of marking that allows time for individual tutoring.

Inhibiting facts of CBAT were also identified. One concern identified the inefficiency of tutoring where several students ask the same question individually. Self-pacing will create this, and instructors find themselves dealing with a range of questions without opportunity to prepare. This creates stressful situations where apprentices may not understand that the instructors cannot have everything available for instant recall. Apprentices often want quick answers to their quick questions and do not want to wait. This leads to the comment of one instructor that the education under CBAT may not be as good as within a traditional delivery class. Apprentices seek to complete the testing as quickly as possible, and many may be missing the education that might come from more structured learning situations. According to one instructor, opportunities are missed to develop writing skills, and the peripheries are missed while focussing on the core materials. It must be noted that apprentices receive short-term skills training, and it is generally thought to be a training program as opposed to an

educational program that might serve to develop the individual beyond the narrow skills needed for employment.

Instructors identified individual learning styles, or preferences, and self-pacing as primary factors inhibiting success. As in any learning environment, not all students are engaged in their preferred approach, particularly when the majority of apprentices surveyed indicate that the particular TTP or program delivery method was not considered. Some would prefer to work on their own time, as in DD, but they must attend as FTs. Good reading skills are required, and self-discipline is required to manage the study time provided. With various instructors involved in the process, consistency can be lost, and confusion can be created for apprentices who prefer to learn via one approach. If instructors do not lecture in theory classes, this is detrimental for ones that need to listen. If instructors do not diversify presentations, the range of learning styles is not addressed. The structure of a traditional lecture program is lacking for those who prefer to attend, listen, and take notes. This is contrasted with the structure that requires FTs to be in certain rooms at certain times. Although ahead of or behind the material being covered, FTs must attend theory classes at times when they might be better served working on CML or engaged in quiet study.

Learning preferences were included in this discussion, as students may only believe that they like or dislike a certain approach. One instructor expressed a concern with the habit of apprentices memorizing questions, taking more module tests than required so that they may see more questions. This learning preference brings surprises when supervised tests are taken, as new questions appear.

Table 58: Comments about CBAT and Training Environment (by Instructor Experience)

Factor	Instructor Experience			
	1st year	2nd year	5-10 years	10+ years
Improvement needed	2	3	3	1
Overall inhibiting	2	1		4
Overall promoting	1	2		3
Learning style	2		1	1
General	4	4	3	5

Note. More than one response may be given by a respondent.

Table 59: Comments about CBAT and Training Environment (by Instructor Assignment)

Factor	Instructor Assignment	
	Periods 1 and 2	Periods 3 and 4
Improvement needed	2	4
Overall inhibiting	6	3
Overall promoting	4	3
Learning style	2	2
General	5	11

Note. More than one response may be given by a respondent.

Instructors made the following comments about what they could be doing to increase the success of CBAT and the apprentices:

> Lots of opportunity to work on questions. The program needs to be sure the CML test bank is well designed: random enough, representative of what they need to learn, keep up with modules. It keeps instructor honest, as questions must match the teaching.
>
> A few instructors are starting to explore other options, such as ICQ. Needs administrative start.
>
> A bit of a challenge administratively. Instructors must work closer together. New instructors want to work on their own. Emphasis is on group development work, not individual. Individual work could lessen the importance of the modules. Can't hand out individual handouts. Must integrate into modules.
> Modules could be reworked for clearer direction as to what to do.
>
> Distance should require one week in school in final testing week, to cover key points, complete labs, and write program finals.

> CML geared for fast students, not the slower ones. Social results not measurable but will be there. Will be on the low end—on list for layoff….Less interactive due to CML. Known that computer people are less social. CML is negative. Students want instant answer. Instructor not informed where student is at. What module? Period? Instructor always on the defence. Not sure what is coming. Drains instructor, leading to stress and high blood pressure. Must be prepared to answer all questions on all topics in all years. Lots of pressure. Years of experience to become effective. Impacts on response to student (health, tension, pressure). Instructors don't interact as well. Not at ease. Less comfortable dealing with others. How do they socialize in the field as a result of these studies? Workplace is not laid out in modules.

Instructors made the following comments about the factors promoting the success of the overall CBAT program:

> Automation of the marking frees instructor for student. CML tutor station allows one-on-one assistance.
>
> It is a modified CBAT due to lectures. Best to have lectures instead of strictly CBAT. Good combination. It is not always lecture. They can study on their own. There are assigned lecture hours. Can impress certain material.
>
> CBAT environment nicer for constancy. Didn't always happen in traditional. Flexibility and self-paced is a benefit. Some are returning after an absence. Can adapt to students with absences such as death or illness.
>
> CBAT can be an advantage to go faster. Students can get out in four to five weeks.

Instructors made the following comments about the factors inhibiting the success of the overall CBAT program:

> An inefficiency, that is not major, is that students come individually to ask the same question.
>
> Don't learn writing skills. Not sure if they are turning out the same quality.
>
> More education in the past. All you see is the core. Peripheries not being addressed. Employers starting to see. Very good students would probably get same grade. Mid – could go either way. Poor – have trouble.

Bosses encouraging students to take distance due to shortage or workers.

Instructors made the following general comments about the CBAT program:

CBAT raised the awareness of instructional staff with relation with the needs of industry and competency profiles. Resulting coffee and formal discussions about what should be in the materials and how it should be presented. Stimulated "thinking outside the box" in a new way. Stigma in industry. Think that CBAT is all about computers. Lots more than CML. No other system available to offer the same opportunities to get through the material. In traditional, read 50 pages to get to four pages of relevance. Has faith in the system. Most problems within themselves (don't like school). CBAT needs time to evolve. Away from competency-based as it was at the beginning. Those distance students that complete seem to like it. Marks relatively the same for one month or six months completion. Program does a good job of attending to needs of students. Those that do distance and succeed are very independent learners. Those without discipline and focus don't succeed. Need family and advisor support. Impressed with system. Recalls spending time listening to lectures on what he already knew.

Summary of Analysis of Findings

Three main sections were covered in this chapter: characteristics of the population, analysis of the responses to apprentice interviews, and analysis of the responses to instructor interviews. The characteristics give a snapshot of the apprentices through several aspects, while the instructors are identified by years of experience with electrician apprentice programs and current assignment. Apprentice interviews were detailed by summaries of the themes that emerged. Similarly, the instructor interviews were themed and presented numerically together with some illustrative comments to highlight the responses.

Interviews were conducted with 29 of 235 apprentices (12%) in full-time (FT) studies at the time and with 11 of 146 apprentices (7.5%) in distance delivery (DD) studies. A greater representation of distance students (DDs) would have been preferable, particularly since it is this area that may benefit the greatest from the results of the study. However, as previously described in Chapter III, access to them was limited. Also, only 46% of DDs completed their program and 44% passed the government exam. Withdrawal was recorded for 54%. With many not fully participating in their studies, their interest in a study was not expected to be strong. This compares with 97% of FTs that completed their technical training and 92% that passed the government exam. Overall, the apprentices represented those that were ahead of schedule in their pace, behind expectations, and keeping up to where they should be at.

Several themes emerged, and these were identified as success-promoting or success-inhibiting factors. These factors provide an indication of what is working and what could be improved, providing part of the answer to the research questions.

1. Print modules provide the core learning material to support a self-paced program, both in the classroom and at a distance.
2. The CBAT program could not function as it does without the computerized testing and recordkeeping. However, little credit is given to the use of computers. The associated tutorial given on a one-on-one basis by instructors offers significant support to FTs. However, the noise and distractions of the CML labs inhibit those who are trying to work quietly. While the DDs can access this tutorial, it creates challenges for those who are not local and cannot visit during regular hours.

3. Theory classes are deemed important by FTs, but the way that they are offered in this self-paced program inhibits progress. DDs do not have access.
4. Lab classes provide a beneficial environment to gain hands-on experience. Apprentice progress could be increased with more instructor support and greater access for DDs.
5. Apprentices assist each other in understanding the program content, although noise and distractions inhibit the study concentration of others. This factor is not designed into the program. DDs do not have a communications facility.
6. Videos might be a useful learning tool, but outdated ones and an inability to take them home minimize the viewing by FTs and DDs.
7. Student advisors were seen to be an important resource, although the level of utilization varied and communication between DDs was challenging.

Interviews were also conducted with 25 of 35 (71%) instructional staff. The study found that the most significant factors promote the success of FTs were the self-paced program and the tutoring. Factors most inhibiting their success were the apprentices' individual learning styles and the self-paced program. This suggested that there might not be a perceived match between the choice of the apprentice and the program delivery method taken, but the tutorial is successful in guiding students through the program. This is supported by the high completion rate demonstrated.

The most significant factors promoting the success of DDs were identified by instructors as the accessibility and flexibility of the program. Factors most inhibiting of the success were seen to be the lack of support and the program structure. This presents a program that provides ready access to apprentices but truly makes them responsible for their

learning. While successful for many, the high non-completion rate may speak for the inappropriateness of this delivery method for others or an opportunity to provide enhancements to meet the needs of those who are best served by distance delivery.

This program's CBAT was described by a couple of instructional staff as being a modified form of CBAT. The study found the program to be modified from the original CBAT concept, but this may be no more than an evolution of CBAT. The term is one applied to Alberta apprenticeship programs, and the name is not the issue. It is a form of apprenticeship training delivery that uses competency-based approaches. The literature revealed that competency-based delivery does not prescribe the program structure.

Apprentices and instructional staff described a program that is unfamiliar to many entering but capable of training apprentices in alternate ways from the traditional delivery method of instructor led classroom instruction. The factors that are working, albeit in some need of updating, were identified in relation to FTs. Conclusions may also be drawn in relation to factors that may enhance the FT and DD methods. Chapter V addresses these factors in the form of recommendations to make the FT sites more conducive to learning with the intended self-paced concept and to provide more support to DD apprentices.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The researcher commenced this study with the assumptions that CBAT is a positive method of training apprentices and CML is a valuable tool that benefits students and instructors. The study was structured to investigate the instructional factors that promote the success of CBAT and those that should be identified as inhibiting the success. With both FT and DD formats in use, the factors relating to one could provide insight into possible improvements of the other. The focus on instructional factors was intended to limit the scope of the study, but it became apparent that non-instructional factors were important and identified by participants.

Instructors were asked directly about the factors that promote and inhibit the success of CBAT programs. Apprentices were asked a series of questions from which the questions could be answered indirectly. Responses are considered in relation to the original CBAT concept objectives that were established: self-paced learning, individual progress, frequent and immediate feedback, standardized competencies, predetermined individualized evaluation, predetermined commencement/individualized completion, uninterruptible learning, competency pre-test, and post-course evaluation (Dohei et al., 1986, Appendix D). Not all of the objectives are addressed; however, the objectives become very pertinent when inhibiting factors are those that contradict the original intention. In particular, this study considers issues relating to self-paced learning and individual progress.

The two research questions being answered are as follows:

1. What are the factors that promote or inhibit the success of CBAT programs, as perceived by apprentices and instructors?
2. Are there differences in success-promoting or success inhibiting factors in the classroom-based CBAT program in comparison to the distance-based program?

The CBAT program was originally introduced as a self-paced program that would allow apprentices to proceed through prepared materials, take tests when ready, and exit the program when completed. An early release may benefit the apprentice, with a return to gainful employment, the employer, welcoming back its trained and freshly motivated employee, and the TTP, whose instructors can focus on those apprentices requiring more attention. Changes in recent years have added the DD method, providing a more flexible way to take the self-paced CBAT. Some perceptions of CBAT remain constant, but many vary according to the method of course delivery. These differences are addressed while also distinguishing between the success-promoting and success-inhibiting factors for FTs and DDs.

Instructor Perceptions of Factors Promoting the Success of Apprentices

Instructors perceive the self-pacing and the tutoring to be most beneficial to the success of FTs. The self-pacing opens up the program to meet the individualized needs of apprentices, permitting them to work ahead when able, and to seek help as needed. The most obvious support point is the tutor desk in the CML lab, allowing apprentices to address a wide range of questions. Other factors mentioned by instructors are supportive of the program, including the ability to respond to a range of learning styles, mandatory lectures,

the print modules that allow individual progress, the CML that allows testing on demand, and the lab where essential hand skills are practised.

According to instructor responses, the success of DDs is most promoted by the accessibility and flexibility provided. While self-pacing is presented third, followed by the print modules, self-pacing may be counterproductive for most DDs, as it is addressed as a success-inhibiting factor. Accessibility for DDs includes a variety of components. Print modules provide most of the content. Unsupervised module tests may be drawn from any computer with access to the World Wide Web (WWW), and supervised tests may be completed at the TTP or at other authorized locations, including offices of Alberta Learning throughout the province. Time need only be spent in the skills labs when needed for practise or testing, so these may be booked at times convenient to the DD, subject to available space (and other limitations addressed as success-inhibiting). While theory lectures are not accessible, DDs can attend the TTP to access the CML tutor desk, or they can be in telephone and e-mail contact with their assigned advisor. One instructor indicated that DDs are also more likely to access the vast resources on the WWW, as they are using web access more often. Accessibility to technology is a key component in the ACTIONS model that describes the usefulness of technology in distance education (Bates, 1995)

DD flexibility puts the apprentice in control of when and where studies take place, allowing paid employment to continue and avoiding temporary relocation for some of them. DDs are assigned a period of six months to complete their studies, with nine months for fourth period. DDs do not face the same constraints of FTs, requiring attendance in certain rooms at certain times each day. The accessibility, combined with a flexible structure,

including self-pacing, provides opportunities for DDs to continue studies without financial and personal burdens faced by many FTs.

Apprentice Perceptions of Factors Promoting the Success of Apprentices

FT responses affirmed the inclusion of tutorials as a factor promoting the success of CBAT, with the assistance of instructors rating high as a factor of CML most supportive of learning by 59% of them. The inclusion of the instructor component in much of the program was very positive, as one-on-one contact occurs in the labs and with the designated advisor. It appears that self-pacing is not a feature of interest, as only one FT chose studies at this TTP for the CBAT program. The TTP was chosen by 83% of TTPs because it is near their home or other accommodation. FTs identified other success-promoting factors, as they were asked to comment on a range of areas, covering print modules, CML, theory classes, lab classes, the help of other apprentices, videos, and their advisors.

Attention to instructional design is an important factor for FTs, particularly relating to print modules. The instructional component of theory classes was significant, lessened in importance due to pacing issues discussed as inhibiting. Hands-on practice was important in the lab classes, and the help of other apprentices was significant to 100% of FTs. Videos, when used, provided variety in the approach to different learning styles, and they increased understanding to a lesser degree. Advisors provided support to FTs in support of their learning, including lab instruction, but other content questions usually fell to the CML tutor desk.

DDs did not mention instructional design factors relating to print modules as often as FTs did (55% versus 72% for FTs), but they did rank it first. For CML, responses were

spread among different categories, with two or three in each, so instructors and the tutor desk were not identified in a significant way. Theory classes were not applicable to DDs, with their comments as a result of prior experience as a FT. Hands-on experience in the lab was only significant to 45% of DDs, leading to the question as to whether DDs are generally receiving much of this experience in their employment. The assistance of other apprentices was credited by 55% of DDs, including that obtained while at work. Positive comments of a general (classified as "other") nature were made by DDs about videos, suggesting value for those choosing to watch them. Advisors were credited by 82% of DDs for the support provided. As this was the only area where most DDs commented in a favourable way, it is suggestive that the advisors are the strongest factor toward the success of DDs in the CBAT program.

Instructor Perceptions of Factors Inhibiting the Success of Apprentices

Instructors identified learning style (34%) and self-pacing (34%) more often as factors inhibiting the success of FTs. Learning style, as categorized by the researcher, encompassed a range of concerns, including the approaches taken by apprentices to learning the material. Some FTs prefer to work on their own, but they are required to be in classrooms at scheduled times. It is not structured enough for others, and it is detrimental for those who lack self-discipline or have weak reading abilities. While the theory classes may be of benefit, they do not help if the instructor does not lecture. The level of learning taking place was also identified by two instructors. Some apprentices memorize the questions without full understanding, and this can affect them when writing the government exam using different questions.

Self-pacing is also a concern when FTs lack the self-discipline, time management skills, or ability to keep up with the pace required to complete. The self-pacing benefits those who can move ahead, but others may get too far behind. While a limited extension may be permitted for FTs who have made reasonable progress, self-study can be a difficult process.

The success of DDs is most inhibited by support issues and program structure issues, mentioned by 55% and 41% of instructors, respectively. While some DDs proceed with few difficulties, instructors identified what DDs miss, including lectures and a quick response to questions. They have limited access to instructors and apprentices, no after-hours support when they may be working on modules, and limited attention in the labs. To register as a DD apprentice means accepting responsibility for personal progress through the program. Distractions stand in the way of many DDs, and some form the reasons why DD was chosen: to avoid a commitment to classroom attendance. For example, family commitments and employment are reasons to study at a distance, but they also limit the time to study.

Apprentice Perceptions of Factors Inhibiting the Success of Apprentices

Apprentice responses identified a range of factors that are least supportive to their learning. Instructional design factors relating to print modules were identified by 72% of FTs and 55% of DDs. Many concerns relate to the lack of clarity of some of the topics and diagrams. Additional comments indicate that writing and editing deficiencies also detract from the reading.

FT and DD concerns with the CML suggest that further feedback could be provided for incorrect answers. They further indicated that more questions on tests would allow a better assessment of mastery, rather than failing with one incorrect answer on a short test. To FTs,

the environment is not conducive to good study due to noise levels and other distractions. There are also waits for computers when in use or when system or computer problems occur. While instructors are helpful, FTs (and one DD) did not find they met their expectations at times. For DDs, inaccessibility occurs when instructional support is needed after regular school hours or on holidays, or when communication difficulties between advisor and DD occur.

Theory classes present a significant concern with 55% of FTs commenting on the pacing. While the value of an instructor-led class was indicated as a success-promoting factor, the value is lost for FTs that are either ahead or behind the pace being set. Those who are behind are not ready for the new material, and those who are ahead or behind are distracted by the lectures and other activities while trying to proceed at their own pace. Compulsory theory classes appear to conflict with the self-paced concept of the CBAT program. DDs do not attend theory classes, so they are not affected.

Both FTs and DDs experience wait times when attending skills labs, and FTs are distracted when needing to study from modules, suggesting that lab time may not being used in the most time efficient manner. Apprentices indicate that there are not enough instructor resources to meet the needs.

FTs and DDs find that a lack of knowledge on the part of many apprentices fails to support their learning when they try to assist each other, followed by noise and other distractions noted by FTs when such activities occur while others are trying to study.

Many FTs and DDs do not watch available videos, but others (45% of FTs, 27% of DDs) commented on the presentation, primarily in relation to it being old and boring, and in need of updating.

With regard to advisors, 36% of DDs indicated accessibility or contact concerns. Together with other comments received during the study, it is noted that DDs do not have ready access to advisors, having to await e-mail or telephone replies. This is particularly difficult for apprentices without ready access to a telephone during the daytime, and when e-mail communication is not desirable. A lack of regular contact detracts from the relationship and ability to follow progress. It is instructive, however, that 72% of FTs and 36% of DDs offered no input relating to the way in which advisors are least supportive to learning. When asked what aspect of the training is most helpful to their learning (question 17, Table A37), 38% of FTs indicated it was the labs, followed by theory modules and classes (21%), instructors (17%), and the ability to ask questions in CML (7%). Most DD responses covered a range of areas.

As anticipated, FTs saw flexibility in the DD delivery that they wished to access, while DDs offered insight into factors that distracted their progress, some of which could assist FTs. Instructors also provided their perspective in the success factors, and other conclusions and recommendations were reached through observations made by the researcher.

Program Delivery

The TTP offers two delivery methods for the Electrician Apprentices Program (EAP), allowing access that should serve a greater portion of the population. For those desiring a traditional approach to apprenticeship classes, focussing more on instructor-led training, other institutions may be accessed. However, apprentices are not always aware of the options, and they may be in a program not best suited for their learning styles or interests. Findings from this study indicate that DDs are often in this method of study due to

circumstances that do not allow their full-time attendance. Even if DD is chosen, challenges stand in the way of using the system to their best advantage. FTs usually find themselves in the program closest to home, with little or no opportunity to choose between CBAT and traditional delivery. With a greater understanding of the factors that promote or inhibit their success in CBAT, it is likely that the program may increase its responsiveness to the needs of its students.

Whether they appreciate it or not, some apprentices function better with a structured environment. Others need or desire the flexibility of independent study. The best delivery would involve a balance between structure and independence, varying for each individual. A starting point is to examine what this TTP purports to offer and how it is helping or inhibiting one customer set, the apprentices. It may be possible to provide comments to apprentices to direct their studies in the most efficient manner; however, much is beyond their control. The findings presented are best directed toward the stakeholders that can influence the system.

FT delivery requires that apprentices attend a specific campus location, between set hours. Apprentices proceed at their own pace through the instructional modules and lab testing, with provisions to leave early, if completed, and limited opportunity to extend the stay. Resources are provided to support their learning, particularly in the CML Lab where instructors answer questions about the test results and general course content. A dichotomy is presented, though, as apprentice time to proceed on a self-paced basis is limited by a schedule restricting the ability to work independently at a chosen pace.

The CML lab provides the most flexibility, as apprentices can study modules, take tests, review tests and other questions with instructors, engage in discussions with apprentices, leave the room for a break, or work on something unrelated. With so much going

on in the room, though, distractions are at their highest level. Apprentices may be drawn into unrelated conversations of interest, interrupted by questions, or distracted by nearby conversations. There may be delays waiting to speak with an instructor, and access to the computers is not always available. The test taking room is quiet, but it is not available for quiet study. FTs may also access the computers from other computers on- or off-campus during non-CML assigned time, including theory classrooms.

Theory classes pose the greatest irritation to apprentices. While each instructor may have a different approach, the class time is often used for instructor presentations on topics most applicable to the pace of the apprentices. Some FTs fall behind and others proceed quickly. Those who are behind are not ready for the lecture or discussion. While they may be allowed to work independently on their theory, they remain in the class and are distracted by the talking around them. It can be argued that those moving ahead could benefit from a review with the instructor of the material already covered. This is contrary to concept of the competency-based program, as it is intended that they leave the program as soon as they have completed it. They, too, are distracted by discussions of past material while they want to be study new modules to which they have progressed.

Labs are provided for the practice and testing of hand skills. Some apprentices are not ready to work on the skills, needing to catch-up on theory, while others are delayed waiting to have their work checked so they can move to another skill. In fact, if the work is not checked, it must be repeated in the next class.

DDs generally do not face the constraints placed upon FTs. DDs may choose to use the CML Lab, but access is available off-campus from any computer with access to the World Wide Web. This includes testing at approved locations. DDs book time in the skill labs to

work on several skills at one date. With cooperative instructors recognizing their limited time, some find significant progress can be made, although this may be to the detriment of FTs who do not receive the same attention. Other instructors do not give more attention, so DDs wait their turns and do not accomplish as much in one day.

DDs miss the structure afforded FTs. While some can function within an unstructured program, others need more. The factors that cause a high percentage of DDs to not complete the program should be investigated, with consideration given to the lack of structure. Of interest is Moore's theory of transactional distance (Moore, 1993). As a pedagogical concept, Moore referred to the separation of learner and teacher and the need to address this through program structure, communications, and the extent to which the learner is self-directed (p. 22). The degree of psychological and communication separation affects the approaches and responses of teachers and learners (p. 22).

Many of the concerns are met by administrative hurdles, but these may not be insurmountable. Alberta Learning and Human Resources Development Canada fund FTs to attend school, so full-time attendance is expected. Within the campuses, scheduling provides accountability for the location of apprentices and addresses some instructor workload assignment concerns. Leaving the latter as an area for further study, factors promoting or inhibiting the success of apprentices may be addressed through the following considerations.

CBAT is presented as an individualized program allowing for rate of progress. This form of individualization is common, and Baker (1978) noted that "only individualization with respect to rate of progress appears to have been implemented consistently" (p. 8). At this TTP, attention to the individualization of rate of progress could be enhanced to positively

impact both FTs and DDs. Apprentice and instructor responses suggest a series of potential changes to the CML, skill labs, theory class, and overall administration and scheduling.

CBE recognizes what is already known, so compulsory theory classes do not fit within the realm and could be replaced by videotaped presentations on all applicable topics. Should mastery be achieved on pre-tests, the video lesson might not be required. When further study requirements are identified, the lessons can be made available at the time the specific lesson is needed. While apprentices can watch as a group, sufficient copies should allow for overnight or weekend loans. Discussion with instructors can be deferred to the tutor desk now located in the CML lab.

Skills labs provide the environment where apprentices practice hand skills and are tested on their successful completion. DDs may accomplish of their testing by attending a few days, while FTs attend for 80 hours over 8 weeks (first to third periods), or 120 hours over 12 weeks (fourth period), assuming attendance for the regularly scheduled length of training. Lab attendance could be filled on a sign-up basis, for DDs and FTs, when the apprentices are ready and for the period of time needed.

Components of the CML lab are crucial to the success of CBAT, but changes are indicated that may include new areas. The CML could be confined to the use of computers for module and supervised testing. For full use of instructor resources, the tutor station could continue to be attached. A quiet study area is essential, whether attached or in a different room. It could be known as the Study Hall.

Apprentice attendance is a concern, yet it need not be if apprentices are exceeding progress expectations. Attendance could be enforced with apprentices falling behind, by

requiring a study plan that would detail where they would be working. This could include additional private or group tutoring in difficult subjects.

Apprentices and instructors presented their perspectives on the instructional factors that promote and inhibit the success of CBAT. This input was instrumental in development of the following characteristics of a successful program.

It is recognized that not all students will be able to obtain mastery within a reasonable period of time. For administrative purposes, limits must be placed to allow for class scheduling and an efficient use of resources. The responses to question 9 suggest that unlimited attempts are not required to attain mastery. With only two apprentices reporting usually taking more than three attempts and one of those indicating it was for practice, the study results suggest that more than three attempts should be reserved for instructor exception. This would reduce the use of resources that include line-ups for the computers. All but two apprentices (95%) reported that they usually received a mastery grade or an instructor pass within three attempts of the module tests. Some apprentices purposely take more tests that needed in order to see additional questions. This is not to suggest ignoring the 5% that needed more. They could be dealt with on an exception basis, allowing early identification of weaknesses and needs for additional attention.

Optional review tests were taken by 53% of the apprentices, but other review tests may be accessed prior to writing final examinations. This suggests that they are being used for study purposes on a voluntary basis.

Summary

Results suggest that the structure keeps FTs on track and may aid their progress. Similarly, compulsory lectures provide a method of teaching that is more readily accepted by many as preferable to self-study. However, the same conditions, imposed on apprentices that are performing ahead of the average, can inhibit success and progress. For apprentices to escape the regimen, they must register in the DD program. Without financial support, they must then continue to work, and that affects their ability to study.

The factors that appear to promote the success of CBAT programs, as perceived by instructors and apprentices are as follows:

- Quality print modules are essential to guide independent study. Attention to instructional design and editing will are needed to provide modules that are easy to read, provide clear and concise information, and are consistent with tests that will be administered. High quality diagrams are required, using colour to differentiate between components.
- Instructional staff members are most effective in an individual or small group tutoring capacity, easily accessible to both FTs and DDs, as apprentices are at various points in a self-paced program.

The success of CBAT programs is apparently inhibited in the following way:

- Obstacles are placed in the way of FT and DD apprentices who try to take advantage of the self-paced nature of the program. FTs are not able to structure their learning day as they see fit, with required attendance in classes at times that they could be working on more timely areas. Some DDs experience difficulties communicating with instructors in

a timely manner, due to study outside of regular hours and work that restricts telephone access, and access to skills labs is limited.

Differences between FTs and DDs in success-promoting and success-inhibiting factors are observed as each is considered in this study. One major consideration, though, is accessibility. FTs have access to all resources, although there are limits to the times of access and a lack of control over some resources, such as compulsory lectures. DDs have considerable flexibility in their program and their access to resources, but there are limitations on access.

It was anticipated that some DDs would indicate a need for more instructional assistance that may be delivered at a distance, and a desire to continue having access to the FT resources, such as attending labs. Some FTs were likely to ask for less individualized learning while seeking the flexibility that is enjoyed by DD students. This result could result in an opportunity to promote distance studies as an alternative to the more rigid timetable attributed to FTs. Further, it was predicted that additional instructional approaches might be identified for both FT and DD delivery.

Recommendations

Self-pacing was one of the original CBAT concepts. It has not been a significant factor relating to the success of apprentices in the program, but it has inhibited the success of many apprentices and the program. Secondly, concerns with access to resources have been noted as applicable to FTs and DDs. Recommendations submitted for consideration are classified by FT and DD, although some points apply to both delivery methods. Recommendations are predicated on continuing the self-paced opportunity for those able to progress at a

satisfactory rate, while providing more structure for those requiring assistance. This includes DD, where more monitoring of progress rates would be required.

Full-time

- Remove, or make optional, daily class periods for those achieving at or better than the expected rate of completion.
- Provide lab access on an as-needed basis, anticipating reduced needs requirements following the implementation of computerized instruction (discussed below).
- Offer specific study areas for the following activities:
    - Individual quiet study.
    - Small group discussions and/or group tutorial.
    - CML testing and computerized lesson study.
    - Individual tutorial.
- Eliminate or reduce mandatory theory classes, conditional upon the following:
    - Computerized access to lessons.
    - Optional classes to meet the needs of apprentices at specific progress points, particularly for more difficult material.
    - Remedial tutorials for small groups.
- Update and edit print modules, with particular emphasis on enhancing pictures and diagrams.
- Increase the number of computers to meet demands for computer-assisted instruction.
- Allow access to enhanced communications for interaction after hours and with DDs (see DD recommendations).
- Provide computer-assisted instruction.

- Individual lessons may be stored on CDs or a hard drive or the World Wide Web (WWW).
- Updated video segments may be digitized for retrieval and playing on computers.
- CAI implies more than access to the lessons. The integration of CML is needed to guide students to relevant material to emphasize teaching points or for review.

- Limits must be placed to encourage completion. However, for those truly trying, but struggling, opportunities beyond the maximum extension time could be considered. This might include home study or re-registration with advanced standing for the portion successfully completed. Bloom (1976) stated that "the slowest 10 percent of students may need about five to six times as much rehearsal, practice, or participation in the learning activity as the most rapid 10 percent of students" (p. 122). He further indicated that this can extend to needing 10 times as much in the case of some learners.

Distance Delivery

- Introduce more structure to ensure progress is encouraged and actually occurs.
  - Introduce completion rate milestones (check points).
  - Encourage regular instructor and student contact to provide support and reduce procrastination.
  - Provide more advisor intervention to assist those who are not achieving, with discretion to waive requirements due to exceptional circumstances.
  - Require withdrawal due to an unacceptable lack of progress.

- Study reasons for non-completion and address through registration procedures and requirements.
- Enhance communications between students and instructors with online conferencing, considering the following to increase support and decrease isolation issues:
    - Asynchronous message boards.
    - Class listservs.
    - Tools for synchronous communications allowing student- or instructor-driven discussions on an impromptu or scheduled basis. With text chat as a minimum, consider opportunities for teleconference, Voice Over Internet, and desktop videoconferencing, although the latter two are limited due to online access restrictions.
    - Frequently Asked Questions (FAQs) to address recurring issues.
- CAI can build on development for FT students, providing online access to digitized video lessons and other materials. This would provide lectures on demand when apprentices require them, providing the lecture component that is otherwise not available to DDs.
- Print modules should be updated and enhanced, as recommended for FT.

The "facilitating criteria" established for CBAT anticipated a considerable degree of individualization in the rate of progress:

> After the orientation, the apprentice, in discussion with the facilitator, will agree upon a pace of learning which he/she feels is reasonable. This pace of learning is transcribed onto a goal card which records the apprentice's progress and achievements. (Dohei et al., 1986, p. 5)

Subject to input from the advisor, the established goals may be used to provide a measure, especially for DDs. For FTs, the basic measure is the percentage of the lessons to

be complete in each of the classroom weeks, with slight modifications. DDs have a longer period to work within, so there is more flexibility to set the goals based upon other commitments during the period.

Researchable Topics for Future Consideration

Topics for future research may be drawn from the information presented, to provide further support of one or more recommendations prior to implementation, or as a subsequent evaluative measure. The DD program presents a compelling need for further immediate research, considering the high non-completion rate, while the FT program may be best served by research relating to the recommendations.

- With more than 50% of apprentices not completing the DD program, what are the reasons for non-completion or not starting the program?
- What are the reasons for registering for DD?
- Do non-completers re-register in DD or in another delivery method, or do they leave the trade?
- Is a successful DD apprentice one who is well established and gaining good experience in the field? What are the implications relating to allowing lab skills to be checked off by the employer?
- Would DDs benefit from increased contact with other DDs while studying away from the TTP? Would the implementation of cohort programming, as described by Saltiel and Russo (2001), provide more structure and communication between a class of apprentices to reduce procrastination and promote regular progress within a very flexible program?

- Does removal of compulsory periods change the percentage of students at or beyond expected achievement at a given time?
- To what extent does a cost-benefit analysis justify the implementation of CAI?

Final Thoughts

DD and FT are not perceived to develop the same level of education as a traditional Block Release program, as found during interviews during this study and one previously conducted for Alberta Learning (HarGroup Management Consultants, 2000, pp. i-ii). However, two considerations are relevant. First, apprenticeship is traditionally skills-based training. The higher-order education component may not be intended for short periods of training, finding such approaches more in diploma or degree programs. Second, instructors can identify deficiencies for incorporation into the training if warranted. This can respond to employer and instructor concerns that FTs and DDs do not learn as much about the trade as in Block Release.

Factors have been identified that could enhance the FT delivery, including reducing barriers to self-pacing and increasing learning resources. Enhancement of FT delivery increases the opportunities for DDs. While it may assist those who would otherwise be non-completers, increased resources for DDs would increase access to those who desire DD or cannot otherwise attend FT or other methods of delivery and require the DD program. With the popularity of distance programs in a wide range of disciplines, it is reasonable to assume that enhancements would extend opportunities to those otherwise unable to participate. The more that instruction can be delivered using the Internet, or World Wide Web in particular, the less the need for travel to attend labs or to retrieve study materials such as blueprints. In

the HarGroup Management Consultants (2000) study, it was identified that employers were not aware of alternate delivery options, and recommendations included making further information available (p. 39). Promotion of an enhanced DD program could provide increase revenues to offset development costs over an amortization period.

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Appendix A: Researcher's Letter to Apprentices

January 26, 2001

Dear Apprentice Electrician

You are presently enrolled in a period of technical training at the Northern Alberta Institute of Technology (NAIT) on your learning path to becoming a Journeyman Electrician. The method of instruction used at NAIT is known as competency-based apprenticeship training (CBAT). With the endorsement of the Apprenticeship and Industry Training Division of Alberta Learning, and the NAIT Electrician Programs, I am conducting a study to learn more about the experiences of apprentices with CBAT in their technical training. I would like to understand what it is about the delivery method that makes your studies successful, and I would like to identify factors that stand in the way of your success. This applies to full-time and distance studies.

The study is my final step toward achieving the Master of Distance Education degree from Athabasca University. My enquiry will involve a series of questions being asked by telephone or in person (in Edmonton), taking about 15 to 20 minutes. If you agree to participate, I will treat your responses confidentially, and results will be reported from the group data. If there is a reference to an individual response in the final report, it will only be included if it would not identify the individual making it. All survey questionnaires will be retained for a period of six months past the thesis completion date, and they will then be destroyed.

Your voluntary participation in this study would be appreciated, as the results will contribute to the ongoing evaluation of apprenticeship programs. You are, however, under no obligation to do so. You can withdraw at any time, or you can decline to answer any of the questions. Student marks and standing will not be affected by participation or non-participation in the study.

If you agree to participate, we can set a mutually convenient time for a telephone or in-person interview. My interviews will take place for about 2 weeks. Please contact me by telephone or email, as indicated below. I am available most evenings and weekends.

I can also answer questions regarding the study. Should you have any other questions or concerns, they may be directed, as appropriate, to one of the following persons having interest in the study. Dr. Pat Fahy is my thesis supervisor at Athabasca University (telephone 1-800-788-9041, ext. 6216; email: patf@stu.athabascau.ca). Mr. Jim Sanders is the Program Head, Electrician Programs, at NAIT (telephone 471-7493, email: jims@nait.ab.ca). Mr. Mark Douglas is the Director, Industry Programs and Standards, Apprenticeship and Industry Training, Alberta Learning (telephone 780-427-5735, toll-free 310-0000, email: mark.douglas@gov.ab.ca)

At the conclusion of the study, a copy of the report will be available from the Alberta Learning Library and the NAIT Library. Thank you for your time.

Yours sincerely,

A.E. (Tony) Ratcliffe, Graduate Student
Master of Distance Education Program, Athabasca University
(780) 910-4354 (my personal number for Edmonton and area)
(866) 910-4354 (my personal toll free number)
email: tony@ratcliffe.ab.ca

Appendix B: Sponsor's Letter to Apprentices

THE NORTHERN ALBERTA
INSTITUTE OF TECHNOLOGY

SCHOOL OF ELECTRICAL AND ELECTRONICS TECHNOLOGY

January 18, 2001

Dear Electrician Apprentice:

Enclosed is a letter from Tony Ratcliffe, a graduate student in the Master of Distance Education Program at Athabasca University. Mr. Ratcliffe is conducting his thesis research relating to the system of electrician apprentice training being offered at NAIT both full-time and through distance studies. This study is endorsed by NAIT and the Apprenticeship and Industry Training Division of Alberta Learning.

As indicated in the letter, participation is voluntary and confidential. We have assurances that your responses will not be used in any way that could identify you. Your grades and standing will be in no way influenced by your decision to, or not to, participate.

Mr. Ratcliffe would like to talk with you by telephone, or he can meet with you in Edmonton. He would appreciate your participation, and he will answer any questions regarding the study in advance if you wish. Should you wish to participate, please make contact directly, as specified in his letter.

Sincerely,

J.R. (Jim) Sanders
Program Head
Electrician Programs

Main Campus: 11762 - 106 Street, Edmonton, Alberta Canada T5G 2R1

Appendix C: Researcher's Letter to Instructional Staff

A.E. (Tony) Ratcliffe
807, 8620 Jasper Avenue, Edmonton AB T5H 3S6
Tel: (780) 910-4354; tony@ratcliffe.ab.ca

November 28, 2000

To all instructional staff members
Electrician Programs
School of Electrical and Electronics Technology
The Northern Alberta Institute of Technology
11762-106 Street
Edmonton AB T5G 2R1

Re: Preliminary Study of the Perceptions of Competency-based Apprenticeship Training

As a research project to partially fulfill the requirements for the Master of Distance Education Degree from Athabasca University, I am conducting a study relating to the Competency-based Apprenticeship Training that is offered by your program. The purpose of the study is to identify electrician apprentice and instructor perceptions of Competency-based Apprenticeship Training (CBAT) delivered by classroom and distance studies. I am investigating the instructional factors that support, or fail to support, the success of CBAT. The results of this research are intended to provide valuable input to NAIT and the government that may be considered in the future offering of apprenticeship technical training. This may offer ideas that will assist electrician apprentices and those in other trades. The study is endorsed by NAIT.

Participation in the study is strictly voluntary. As a researcher, I will keep individual responses confidential and will report only group data and comments that would not be identifiable to a particular individual. Results of the study will be made available to the Electrician Programs. The interviews will be conducted by telephone and may be completed in about 10 to 15 minutes. You can withdraw at any time, or you can decline to answer any of the questions.

Your voluntary participation is appreciated. Please identify to Jim Sanders, Program Head, your agreement to have your office telephone number and email address released to me. Alternatively, you may contact me directly to arrange a suitable time for a telephone interview, at 910-4354 or tony@ratcliffe.ab.ca

My thesis supervisor is Dr. Pat Fahy at Athabasca University (telephone 1-800-788-9041, ext. 6216; email: patf@stu.athabascau.ca).

Thank you for your assistance.

Yours sincerely,

A.E. (Tony) Ratcliffe
Graduate Student
Master of Distance Education Program
Athabasca University

Appendix D: Apprentice Questionnaire

A Preliminary Study of the Perceptions of Competency-based Apprenticeship Training at an Alberta Technical Institute

Apprentice Questionnaire

Interview number _____

1. ___Full-time or ___Distance student

2. Period of technical training

___1 ___2 ___3 ___4

3. Class

___AB ___CD __EF

4. Progress to date

(Full-time) ___Ahead ___At expected stage ___Behind

(All) At what specific point are you in the modules? _____

Initial Demographic Information and Academic Standing

5. During your technical training, in which of the following are you residing:

___Usual residence ___With friend or relative

___Hotel/motel ___Other (specify)_____

6. If you commute to NAIT each day from outside Edmonton, approximately how far from the City limits did you travel each way?

___Less than 25 km. ___26-50 km. 51-100 km. ___More than 100 km. __N/A

7. What is your highest level of education?

___High school ___Some university or college

___College diploma Credential:_____

___University degree Credential:_____

___Other trade training and credential:_____

___Other:_____

8. Age_____ (___17-24 ___25-35 ___Over 35)

Page 1

Computer-managed Learning

9. When taking module tests, how many attempts does it usually take to get a mastery grade or an instructor pass to the next module?

___Only 1 ___2 or 3 ___4 or 5

10. How many review tests did you usually take after successfully passing a module?

___1 ___2 ___None

11. On which attempt did you usually pass the supervised exams?

___First ___Second ___Approximately divided between first and second attempt

___None taken

12. Have you fallen significantly behind at any time?

    a. ___Yes ___No

    b. If yes, what help were you offered by an instructor or an advisor?

13. From where do you access the CML?

___CML Lab ___Other computers at NAIT

___Home ___Work

___Other (Specify)_____

General

14. Did you have any previous educational experiences that prepared you for the independent study that you faced in this program?

___Yes ___No If yes, please tell me what it was.

15. For each of the following (except those not applicable), what is it that most supports your learning, what was the aspect that least supports your learning or impacts it negatively, and what would you suggest for improvement:

a. Print modules
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

b. CML (computer-managed learning)
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

c. Theory classes
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

d. Lab classes
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

e. Computer-assisted learning lessons
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

f. Help from other apprentices
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

g. Videos
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

h. Student advisor
   i. Most supportive

   ii. Least supportive

   iii. Suggestion for improvement

16. Is there anything else that you liked, disliked, or want to suggest for improvement?

17. How strongly do you agree or disagree with this statement: In my classes I have frequent opportunities to discuss topics with my instructor and a small group of apprentices interested in that topic?

___Strongly agree ___Slightly agree ___Slightly disagree

___Strongly disagree ___Not applicable as DS

18. Which of the following frequency ranges best describes how often you spent time outside of class with other apprentices for informal study sessions?

___Never ___1 to 5 times ___6 to 10 times

___11 to 20 times ___More than 20 times

19. What aspect of the technical training is **most** helpful to your learning?

20. What aspect of the technical training is **least** helpful to your learning?

21. a. What has been the greatest barrier to your learning, at school or outside, during your technical training?

    b. How did you deal with it, or how are you dealing with it?

22. For what reasons did you choose studies at NAIT (full-time or distance)?

23. My interest is in the factors that promote or lessen the success of the electrician apprenticeship training offered at NAIT. Do you have any additional comments you would like to share?

Appendix E: Instructional Staff Questionnaire

A Preliminary Study of the Perceptions of Competency-based Apprenticeship Training at an Alberta Technical Institute

Instructional Staff Questionnaire

1. In which periods do you teach or have primary responsibility?

   ___1 and 2 ___3 and 4

2. For how many years have you taught in the Electrician Program at NAIT or elsewhere?

   ___years

2.a Do you have responsibility for distance students?

For the following questions, only point form responses are required.

3. What are the instructional factors that promote the success of apprentices attending the full-time period technical training?

4. What are the instructional factors that promote the success of apprentices taking the period technical training by distance studies?

5. What are the instructional factors that inhibit the success of apprentices attending the full-time period technical training?

6. What are the instructional factors that inhibit the success of apprentices taking the period technical training by distance studies?

7. Are there any other comments about CBAT, or other aspects of the training environment that you would like to make?