

## **CHAPTER 4**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **4.1 INTRODUCTION**

An in-depth literature study to provide the background to the issues in this research has been presented in Chapters 2 and 3 respectively. Chapter 2 discussed the foundations of apprenticeship and cooperative education as experiential school-to-work transition strategies and traced their development and current organisation in Canada, and in BC in particular.

Chapter 3 traced post-secondary education in BC by presenting an overview of the main providers of apprenticeship and cooperative education training in the province with a focus on BCIT, its creation and its present day role in apprenticeship and cooperative in apprenticeable trades training. Issues from these two chapters inform this chapter where the research design for the empirical investigation is explained. This was conducted according to the combined quantitative/qualitative paradigm. The quantitative phase (Phase 1) used a questionnaire as the means of data collection and the qualitative phase (Phase 2) used semi-structured interviews as the means of data collection. The sampling techniques, data analysis and measures to ensure validity and reliability and trustworthiness of data are described.

#### **4.2 THE RESEARCH DESIGN**

By virtue of the nature of this study, it was deemed appropriate to conduct the investigation according to the combined quantitative /qualitative paradigm (Schulze 2003). Although the quantitative design is strong in facilitating attempts which seek to predict and explain causal relations among key variables, scholars argue that it excludes members' meaning and interpretation from data which is collected, Adding qualitative data to the quantitative data is a useful strategy to overcoming some of these problems (Schulze 2003).

One of the major distinguishing characteristics of the combined quantitative/qualitative approach is its potential for producing holistic, comprehensive and insightful knowledge (Schulze 2003:1-12). Additionally using the combined quantitative /qualitative approach strengthens the internal validity of the research design which is an important quality for this research. De Vos (1998:360) proposes three ways to design a study that combines the quantitative/qualitative paradigms. One of these is the two-phase design, which has been in this inquiry. The research commences with a quantitative phase followed by a qualitative component as follow up. Each design phase is explained in the ensuing sections.

### **4.3 ETHICAL MEASURES**

#### **4.3.1 Informed consent**

De Vos (1998:25-26) postulate that informed consent relates to the communication of all possible information as accurately as possible about the research to the research participants. The participants of this research are adults with the capacity to give informed consent directly. Consequently the researcher provided information about the research to the participants in both phases either face to face or in a covering letter and formally requested their permission to participate. Issues related to the research such as aims, procedures of investigation, possible advantages or disadvantages were shared.

#### **4.3.2 Voluntary participation**

Participation was strictly voluntary with participants having the freedom to withdraw at any time. This was explained to them before the research commenced.

#### **4.3.3. Anonymity and confidentiality**

Strict anonymity and confidentiality of the subjects were maintained in this study even if the findings are published in future. This was communicated to the participants formally. To achieve this, the names and addresses of data sources are not recorded here and personal characteristics or traceable details of the participants are not disclosed.

### **4.3.1 THE QUANTITATIVE PHASE**

#### **4.4.1 The quantitative research design**

A survey design has been adopted for the quantitative phase of this research. This design allows data to be collected at one point in time from a sample chosen from the study population although the time it takes to collect all of the data desired may take from few days to few weeks or more. (Gephart 1999:1-9). A survey involves asking a large group of people a set of carefully designed and administered questions about a particular issue and can be done in a number of ways: face-to-face with individuals or groups, by mail, or by telephone. Two major types of surveys can be conducted: the longitudinal survey and the cross-sectional survey. In this inquiry, a cross-sectional survey is used in which standardized information is collected from a sample drawn from a predetermined population (Borg & Gall 1979: 286).

The first task in conducting a survey is to determine what has already been written or published about the problem, in other words the researcher conducts a literature review. This has been done in Chapters 3 and 4. In particular, two previous surveys that focused on cooperative programs were considered and their contribution as well as their limitations was described (cf par.1.1.2).

#### **4.4.2 Population and sampling**

##### **a) Sampling frame**

In order to construct a systematic sample, it is necessary to use a sampling frame. In this case, the sampling frame consists of cooperative education employers who have employed cooperative students from the Automotive Service Technician (AST), Heating Ventilation Air Conditioning and Refrigeration (HVAC & R), Industrial Maintenance Mechanic (IMM), and Machinist/Tool & Die (Mach T&D) programs. These are mandatory cooperative programs that have been running for at least 12 years and are not new to industry. The AST and HVAC & R programs are the most successful of the four

programs in so far as graduate placements, recognition of their cooperative diploma, and as far as granting apprenticeship standings. The other two programs are the least successful as far as apprenticeship standings and employment is heavily controlled by collective agreement language.

b) Sampling

Sampling was done by a combination of cluster and systematic sampling technique. According to cluster sampling, cooperative employers were divided into groups by size and geographic location. According to systematic sampling, each member of the study population was listed, a random start was selected and respondents were chosen at equal intervals.

The database of employers is stored in the BCIT's cooperative office mainframe by means of a software program called ACT 2000. This program has been in use for a number of years, is easy to use and very versatile. It allows for tailored made searches by modifying fields in the search mode. Thus, it was relatively easy to extract information such as the involvement of employers with cooperative students during the last four years by program or geographic locations or both. The first query asked of the program was to identify cooperative employers in British Columbia from the four groups. The results are shown in Table 4.1.

**Table 4.1**  
**BCIT Cooperative Ed database – B.C. only**

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<b>Program</b>	<b>Number of Contacts</b>
Auto Service Technician	1339
Machinist/Tool & Die	675
Industrial Maintenance Mechanic	319
HVAC & Refrigeration	383
<b>Total</b>	<b>2716</b>

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Thereafter the program identified employers who have hired cooperative students during the last four years. The four-year limit was chosen on the basis that employers, who had not participated in cooperative during the last four years, would not be able to respond adequately to the questionnaire due to the lack of recent involvement in cooperative. During the last four years, the curricula of the selected programs have changed significantly to accommodate technological changes. The results are shown in Table 4.4

**Table 4.2**  
**BCIT Cooperative Employers – 1999/2003 B.C. only**

<b>Program</b>	<b>Number of Contacts</b>
Auto Service Technician	231
Machinist/Tool & Die	100
Industrial Maintenance Mechanic	45
HVAC & Refrigeration	50
<b>Total</b>	<b>426</b>

Problems can arise in systematic sampling if the sampling frame is ordered in a way that may reflect a trend, which would affect the characteristics in the sample. In this case attention was given to patterns such as predominantly small or large employers, high concentration of respondents in one geographic area, little representation from other geographic locations or unionized versus non-unionized employers. A detailed examination of the respondents' characteristics did not indicate cyclical patterns, selection biases and/or disproportionate sampling. Thus, the number of the sample was 426 respondents (N+426) (see Table 4.2).

#### **4.4.3 Data collection procedure: the questionnaire**

A self-administered mail-out questionnaire using a four-point Likert Scale was employed in Phase I of this study (see appendix A). It was designed to solicit data and opinions on the following topics: company profile and activities; level of satisfaction with the apprenticeship system and the number of qualified journeymen and apprentices; level of

satisfaction with the cooperative system and the number of cooperative students employed during the last four years. In preparing the questions the following guidelines were followed:

- The entire questionnaire was concise so that the respondent did not have to use time 'guessing' what is required;
- Questions were organized from asking about the company size and type of business to asking more specific aspects, i.e. level of satisfaction with the apprenticeship system. This was aimed at building up respondents' confidence in completing and mailing the questionnaire;
- The use of close-ended questions was maximized as they are easier to respond and score;
- The use of open-ended questions was limited as they often produce vague, incomplete answers, and more difficult to score;
- Skip patterns were not used to ensure clarity and completion;
- The questionnaire was well set out, clear and uncluttered; and,
- Explicit instructions were given about the procedure for returning questionnaires; a prepaid envelope was provided to return the questionnaire.

#### **4.4.4 Pilot study**

The questionnaire was pilot tested for reliability and validity related clarifications. A pilot study can reveal ambiguities, poorly worded questions, questions that are not understood and unclear choices and can indicate whether the instructions to the respondents are clear. In other words, the intention is to understand the meaning of the question to respondents, and how they arrive at their responses and to help improve the wording (Ericsson & Simon 1993:375).

The pilot study was carried out in two steps. Firstly, a first-draft questionnaire was submitted to BCIT's Institutional Research and Planning (IRP), two Marketing and Research faculty members, as well as two outside faculty members presently employed in the field of cooperative education. They were asked to provide feedback on the clarity, relevance and pertinence of the questions and to provide comments on the format and quality of the questionnaire and covering letter. Their suggestions were incorporated in the preparation of the final instrument that consisted of 15 questions divided into three strata: company profile, apprenticeship and cooperative apprenticeship programs level of satisfaction and involvement.

Thereafter, during the regularly scheduled employer-student cooperative visits that each cooperative education coordinator undertakes in order to ensure that both employer and student are satisfied with each other's performance, a second-draft questionnaire was given to 27 employers by the researcher. Employers evenly represented the five programs where both regular apprentices and cooperative apprentices are found in the Greater Vancouver Regional District (GVRD) and Fraser Valley. For reasons of economy and time, employers located in the B.C. interior regions were not personally contacted during the pilot. They were asked to comment on the clarity and relevance of the questions, whether the questions should have been phrased differently, the number of questions and if they would like to comment on additional topics relevant to cooperative and apprenticeship. Their suggestions were also incorporated in the preparation of the final questionnaire (Appendix).

#### **4.4.5 Response rate**

A major challenges presented by the use of a survey is to secure a high degree of involvement by respondents. This is particularly true when the survey is carried out by mail. As far as this study is concerned, in within the limits of practicality, the steps followed to ensure a high response rate were:

- A questionnaire and covering letter formed part of the first mail out;
- A second mail out;

- Within 2-3 weeks of the mail out, follow-up phone calls were made to all non-respondents whose place of business is located in the Greater Vancouver Regional District and Fraser Valley was made with a phone call for the remainders outside of the geographical location.

A limitation of this study deals with the low return of questionnaires from respondents (30.6%, N=117). Although Rea and Parker (1992:85) state typically a response rate of 50-60% is desirable in a survey, NCS Pearson, Inc (suggests that today, with a public that has been thoroughly saturated with surveys, a 15-25% response rate in an unsolicited survey would still be an acceptable result and offer the same degree of validity. Follow up was made as stated above but did not generate the expected results. A cross-tabulation of the respondents (cf. 4.4.2; Table 4.1 and 4.2) indicated that return percentages were proportional to the number of questionnaires sent out with AST, the largest group, accounting for 40.2% of the returns, and from smallest group, IMM, with a return rate of 14.5%. Further examination of the respondents' characteristics revealed that 83.4% of employers have apprentices currently employed and that they have taken at least one cooperative apprentice during the last two years. Thus, it was felt that 117 respondents, or 30.6% of the sample could be expected to knowledgeable of apprenticeship and cooperative education. Moreover, the percentages of responses by program (cf Table 5.1) indicate a sufficient number of responses representative of the four program groups.

#### **4.4.6 Analysis of quantitative data**

Coding or scaling refers to the process of assigning numerical equivalent to each answer for each question (Robson, 2003:256). Data coding in this study was achieved by using the Likert Scale technique. A combination of a four and five point scale was chosen as it was felt that this would provide respondents with enough range to express their opinions. The computer software program used to analyze data collected by the survey during Phase 1 was Excel. This program has enough versatility that allows the totaling of the frequency of responses. The responses were then converted to percentage scores for each of the close-end questions and for each of the four strata (employer groups). The statistical analysis was done by BCIT's Institute Research and Planning as they have the

expertise and the resources to do so. Responses from the open-ended questions on the instrument were summarized to highlight major trends.

## **4.5 THE QUALITATIVE PHASE**

### **4.5.1 The qualitative research design**

The design for the second phase of the study is qualitative and descriptive. This phase of the research was a follow-up of the quantitative phase. This phase of the research involved selected participants to discuss the findings of the first phase and to determine how they think the issues can be addressed. A qualitative approach was adopted for this phase of the study because it allowed the participants to relate their lived experiences regarding apprenticeship and coop issues in the work place. Thus, a phenomenological approach was used.

### **4.5.2 Sampling**

The sample in this phase consisted for a small group of six employers. A purposive sampling method was chosen to select participants in this phase of the empirical research. Henning (2004:71) states in purposive sampling the researcher selects participants according to the needs of the study. Further, she (2004:71) indicates that desirable participants forming the sample in a qualitative study should information-rich. Information-rich participants were the central consideration in the selection of the sample for this phase of the research.

Criteria for the selection of Phase 2 respondents were:

- All participants had completed the self-administered questionnaire during Phase 1 and they were among the respondents of Phase 1 who indicated a desire to be contacted further;
- The participants hold senior positions in their respective organizations and they make the final decision in the hiring of apprentices and cooperative students;

- They are thoroughly familiar with apprenticeship training and cooperative education methods of training and they have all experience of being involved in program advisory committees and cooperative educational advisory panels;
- All are familiar with trade qualification credentialing issues and the importance of transferability of credentials from province to province in Canada (Red Seal);
- The interviewer (the researcher) has known them for several years and enjoys their confidence and respect. Thus, it is the researcher's belief that the answers obtained would be an accurate reflection of their views about the issues at hand

Cross-tabulation indicated that the participants were a good cross representation of the four sectors, were representative from small, medium and large firms, and all had apprentices and cooperative students presently employed with them (Table 4.3).

Once a decision had been made on whom to include, each participant was contacted by phone or email requesting participation. A profile of the participants in this phase of the empirical study is presented in Table 4.3.

**Table 4.3**

**Profile of participants for interviews**

<b>#</b>	<b>Program</b>	<b># of Employees</b>	<b># of qualified trades people</b>	<b># of Apprentices*</b>	<b># of Cooperative Students **</b>
<b>1</b>	AST	Over 50	13	2	5
<b>2</b>	AST	1 – 10	3	1	3
<b>3</b>	IMM	Over 50	27	3	3
<b>4</b>	HVAC	11 – 20	9	2	2
<b>5</b>	MACH	Over 50	6	2	6
<b>6</b>	T&D	21 – 30	7	1	3

\* Presently employed

\*\* Hosted during the period 2002/2003

The small sample size (N=6), typical of qualitative research, is the most obvious limitation of this phase of the study. However, this phase was qualitative, interpretive and descriptive in nature and is not generalisable in any way.

### **4.5.3 Data collection**

Personal semi-structured interviews are the survey instrument of choice for Phase 2 of this empirical research. Semi-structured interviews were conducted face-to-face in the privacy of the participants' offices and recorded with their permission on audiotape and transcribed for more formal analysis. Anonymity of individual respondents was guaranteed (4.3.3). A flexible interview schedule was used during the interviews to ensure that the key topics identified in the literature as well as findings in relation to the topics dealt with in the quantitative phase were covered. These included:

- Knowledge of Bill 34 (cf. 2.9.3)
- The impact that Bill 34 has had on apprentice training and recruiting (cf. 2.9.3);
- The place of cooperative education in apprenticeship training (cf. 2.4 & 3.7); and
- The format of the new apprenticeship training system in BC (cf. 2.9.3)

The schedule assisted the researcher to remain on task and ensured that all participants had an opportunity to respond to the key topics (Henning 2004:63). When designing the interview schedule the researcher avoided close-ended questions (yes or no answers). The purpose of the interview is to gather perceptions that are unique to the participant. After a few straightforward questions such as "How many apprentices does your company employ?", the researcher led into more open-ended questions intended to provide subjective data, such as "In your opinion, what impact has Bill 34 had on the recruiting and training of apprentices?" Probing questions based on the quantitative results, were introduced as the interview developed.

#### **4.5.4 Measures to ensure trustworthiness**

Steps taken to ensure trustworthiness of the findings guided this phase of the empirical investigation. In an effort to achieve this, the researcher opted to follow Guba's model of trustworthiness as depicted in De Vos (1998:348-351). The four measures adopted from the model in this phase of the study are the following: truth-value, applicability, consistency and neutrality.

##### **a) Truth-value ensured by the strategy of credibility**

Truth-value was employed in the data collection and analysis process. This was applied to establish the extent of the researcher's confidence in the truth of the findings. The strategy of credibility was applied to ensure the achievement of truth-value in the research (De Vos 1998:331). The goal in applying this strategy was to demonstrate that the research was conducted in a manner that showed that the aspects of the problem were accurately identified and described. The idea of multiple realities in the problem took precedence in this phase of the research. Thus endeavours were made to report these realities as revealed by the participants clearly and adequately (De Vos 1998:349). The following criteria were applied to achieve the strategy of credibility:

- Prolonged engagement: The researcher spent as much time as possible with the participants to become familiar with their working environment.
- Reflexivity: Using a qualitative approach the researcher was unavoidably lined to and could not be separated from the data collection process. Thus, his influence on the process was unavoidable but could be minimized. The strategy of reflexivity was employed to minimize the researcher's influence in this study. This was achieved by the use of tape recorder, observational notes and verbatim transcriptions of interviews.

- Authority of the researcher: The researcher's past experience, academic background and present position in education and training qualified him to conduct this study scientifically (cf 1.4).

**b) Applicability as ensured by the strategy of transferability**

De Vos (1998:349) indicates that applicability is achieved through the strategy of transferability. To achieve this in the study, the researcher presented a sufficient description of the participants and the findings to facilitate comparisons of the findings with similar studies in other contexts if necessary. These findings were also compared with findings from the questionnaires in the quantitative phase.

**c) Consistency as ensured by the strategy of dependability**

The third criterion of trustworthiness considered in this phase of the research considers the consistency of the data or its reliability. This is explained in terms of the dependability of the data that is whether the findings would be consistent if the study were replicated with the same participants or in a similar context. Dependability was achieved by creating an "inquiry audit trail" (Polit 1999:71) in the form of a clear outline of the research procedures followed, which an external reviewer could follow if necessary (cf 4.5).

**d) Neutrality as ensured by the strategy of conformability**

Neutrality in this phase of the research was ensured through the strategy of conformability, which was realised through prolonged engagement in the field and reflexivity as well as clear description of research procedures (par.4.5) and when other truth-value and applicability strategies described earlier were implemented (De Vos 1998:350).

#### **4.5.5 Data analysis**

Data analysis took place during the interview process as well as after the interviews was completed. Interviews were modified to include new questions and topics proposed by earlier participants. Analysis of data obtained from the interviews was done by allowing themes to emerge from the data, coding and categorising these themes. In trying to make sense of the data, transcriptions of interviews were read and re-read and tentative categories and sub-categories emerged. Investigator triangulation (Johnson & Christensen, 2000:208) comprised using experts in the field from BCIT Institutional Research and Planning to discuss findings. Moreover, data was triangulated by participant feedback, that is, crosschecking information and conclusions with actual participants for verification and insight (Johnson & Christensen, 2000:208). To do this, several follow-up telephonic discussions with participants were held by means of confirmation information and clarification. Finally, extracts from the raw data were selected and either paraphrased or suitable quotations from the written responses were selected as rich data to illustrate the categories.

#### **4.6 SUMMARY**

The research design for both the quantitative and the qualitative phases of the research has been covered in this chapter. Research procedures including sampling, data collection, and data analysis, issues of validity and reliability and trustworthiness of data have been covered. In the next chapter the results of the empirical investigation are presented and discussed.